EPA/ROD/R04-97/019
1997

EPA Superfund
Record of Decision:

TOWNSEND SAW CHAIN CO.
EPA ID: SCD980558050
OU 01
PONTIAC, SC
12/19/1996

<IMG SRC 970190>

RECORD OF DECISION

REMEDIAL ALTERNATIVE SELECTION

TOWNSEND SAW CHAIN COMPANY SITE

PONTIAC, RICHLAND COUNTY
SOUTH CAROLINA

<IMG SRC 97019A>

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ATLANTA, GEORGIA

DECEMBER 1996

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Townsend Saw Chain Company Site, Pontiac, Richland County, South Carolina.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial alternative for the Townsend Saw Chain Company Site, Pontiac, Richland County, South Carolina, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). This decision is based on the administrative record file for this Site. The State of South Carolina concurs with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This remedial action is the final action (remedy) for this Site. It addresses the principal threat posed by the Site, which is contaminated groundwater. It also addresses contamination in other media. The selected alternative utilizes an innovative treatment technology referred to herein as "insitu chemical treatment," to immobilize chromium by chemically altering it to its less-toxic trivalent state, reducing both the toxicity and volume of the affected groundwater. Additionally, continued operation of the Interim Action pump-and-treat system during treatment will also lessen the mobility and volume of contaminated groundwater, although in a slower manner. Therefore, this remedy meets the statutory preference for remedial alternatives which reduce the toxicity, mobility or volume of contaminated media.

The components of the selected remedy include:

SOIL TREATMENT (Source Control)
- Excavation and removal of uppermost highly-contaminated soils
- Treatment of surficial soils through insitu chemical treatment

GROUNDWATER REMEDIATION
- Insitu chemical treatment of groundwater
- Continued operation of the Interim Action Pump and Treat System (IAPTS)
- Sediment removal action at the Seep (Offsite Area)

SITE MONITORING
- Continued quarterly sampling/analysis of Site groundwater
- Additional quarterly sampling of surface water in the unnamed offsite tributary
- Periodic sampling of treated Site soils

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative/treatment technology to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element.

Because this remedy will result in groundwater containing hazardous substances remaining onsite above health-based levels until the remediation levels are attained, a review will be conducted within five years after commencement of the remedial action, to ensure that the remedy continues to provide adequate protection of human health and the environment.

<IMG SRC 97019B>

RECORD OF DECISION
TOWNSEND SAW CHAIN COMPANY SITE

TABLE OF CONTENTS iv

TABLE OF CONTENTS (cont'd)

APPENDIX B: STATE OF SOUTH CAROLINA CONCURRENCE LETTER

RECORD OF DECISION
TOWNSEND SAW CHAIN COMPANY SITE

LIST OF FIGURES AND TABLES

RECORD OF DECISION
TOWNSEND SAW CHAIN COMPANY SITE
Pontiac, Richland County, South Carolina
December 1996

1.0 INTRODUCTION

The Townsend Saw Chain Site is a small manufacturing facility located approximately 10 miles east-northeast of Columbia, South Carolina (Figure 1). The facility is active and is presently owned by Deere and Company (John Deere). It was formerly owned and managed by the Homelite Division of Textron, Inc., located in Charlotte, North Carolina. In use since 1964, the facility has been used since 1972 for the manufacture of the saw chain, bar, and other components of chain saws. Prior to 1972, between 1964 and 1971, Dictaphone Corporation manufactured specialized recording equipment at the facility.

Between 1966 and 1981, under both Dictaphone and Townsend Saw Chain Company (later Homelite Division of Textron) ownership, waste rinsewaters produced during metals-plating and other processes were disposed of by direct discharge to the ground surface in the low lying "waste pond" areas adjacent to the facility on the north side. These discharges caused contamination of Site groundwater. The main Site contaminant is hexavalent chromium.

The South Carolina Department of Health and Environmental Control (SCDHEC) has overseen environmental investigations and ongoing remediation of groundwater at the Site since 1982. The Site was evaluated by EPA for possible inclusion on the National Priorities List, using the Hazard Ranking System (HRS), in 1987. Because of the potential threat to groundwater and the large number of people in the surrounding area served by water wells, the Site was assigned an HRS score of 35.94, and was proposed for listing on the NPL in June 1988. The Site was listed on the NPL in February 1990. Potentially Responsible Parties (PRPs) named at this Site are Textron, Inc. and Dictaphone Corporation (later Pitney Bowes).

In August 1991, Homelite Textron, Inc. ("Textron") signed an Administrative Order on Consent to perform a Remedial Investigation/Feasibility Study (RI/FS) at the Townsend Site. RI field work began in May 1992 and continued, in two phases, through December 1993. In late 1993, groundwater data appeared to indicate that the areal extent of chromium-contaminated groundwater in the surficial aquifer was greater than previously believed. Because data indicated (1) that nearby potable water wells could be impacted at unacceptable levels unless measures were taken to intercept and/or control the offsite movement of the contaminant plume, and (2) that a potential for harmful ecological effects existed in and along the unnamed offsite tributary and Spears Creek, EPA issued an Interim Record of Decision in December 1993. Textron voluntarily agreed to perform-this Interim Remedial Action, which was described in EPA's Unilateral Administrative Order (UAO) of May 4, 1994. The interim action consisted of the following:

<IMG SRC97019C>

a) a short, focused hydrogeologic study to define contamination extent; b) design of an offsite pump-and-treat system to intercept the migrating groundwater and direct it to onsite water treatment equipment, followed by appropriate disposal; and c) construction and operation of the system. A five-well pump-and treat system was constructed between June and December 1995 and began operations in December 1995.

This Record of Decision documents the selection of the final remedial action (remedy) for this Site. It addresses contamination of groundwater, surface water, soil and sediment at the Site. The principal threat posed by the Site is exposure to contaminated groundwater. This future potential risk to human health will be reduced or eliminated by the proposed remedy described in this Record of Decision.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Description

The Site is located in Richland County, South Carolina, approximately 13 miles east-northeast of downtown Columbia, at the intersection of Interstate Highway 20 and South Carolina Road 53 (also known as Spears Creek Church Road). The nearest municipality is the town of Pontiac, approximately two miles north on SC 53. Fort Jackson military reservation is located across Interstate Highway 20 south of the Site (Figure 2).

The facility property consists of approximately 50 acres. A barbed-wire fence and the main entrance gate are located along the northeast property line (SC Road 53); at the northernmost corner of the property it joins a 7-foot metal mesh fence which encloses the property to the north, west and south. Across SC Road 53 to the northeast is a large single parcel of land (approximately 350 acres) onto which contaminated groundwater has migrated (the ("offsite areas"). Throughout this document, the terms onsite and offsite are used to denote locations within the facility property ("onsite") and those across SC Road 53 generally in the northeast direction ("offsite").

During the RI, the five areas shown on Figure 3 were investigated, in addition to the offsite unnamed tributary of Spears Creek. The tributary is fed by a small seep or spring located approximately 560 feet north of the property boundary along SC Road 53.

<IMG SRC 97019D>

<IMG SRC 97109E>

2.2 Site Topography, Drainage and Climate

The Site lies within the Upper Coastal Plain physiographic province. Topographically, the region is characterized by flat or gently rolling terrain dissected by densely vegetated streams and creeks. Soils in the area consist predominantly of quartz sand, resulting in high soil permeability and rapid infiltration of rainwater into the underlying geologic units. There is little or no surface runoff during or after rainfall.

The Site property is generally flat; elevations onsite range from 350 to 375 feet above mean sea level. The whitish, sandy surface soils are generally poor, containing little organic matter. Trees and vegetative cover generally consists of scrub oak and short loblolly pines, with little underbrush, except near surface water, which supports more diverse flora. The spray field area south of the plant is covered by perennial grasses.

The nearest significant drainage is the above-mentioned spring, which feeds an unnamed tributary of Spears Creek. The tributary flows northeastward to its confluence with Spears Creek. To the south along Interstate 20 there is a drainage ditch which only intermittently carries water. There appears to be no direct (surface) drainage of any portion of the Site to any drainage features.

The climate of Richland County is generally mild, with hot humid summers and short winters. The major influences on climate are the Atlantic Ocean, which provides humidity, and the Blue Ridge mountains north and northwest of the county, which impede the eastward movement of cold air masses. Average midafternoon humidity is about 55 percent. Precipitation, averaging close to 46 inches annually, is evenly distributed throughout the year. Based on Columbia Airport data (located 20 miles distant), prevailing wind direction is from the west to west-southwest. However, measurements from an onsite weather monitoring station operated between November 1992 and October 1993 indicate that wind from the south-southeast predominates at the Site. A high percentage of sunshine (60% winter, 65% summer), combined with the highly porous sandy soils, generate high infiltration and evapotranspiration rates which greatly reduce surface runoff.

2.3 Surface Water and Wetlands

As noted above, the nearest surface water is the unnamed tributary to Spears Creek (Figure 2). There appears to be no surface water drainage from the plant property to the tributary. The absence of

direct overland drainage of water to the tributary and measurements of the water table indicate that it is fed almost entirely by groundwater flow. A narrow band of wet, marshy, heavily-vegetated soil forms the banks of the unnamed tributary, from its origin some 560 feet northeast of the facility property line to its confluence with Spears Creek, which is approximately 2,700 feet northeast of the property boundary along SC Road 53. A broad wetlands area along Spears Creek, approximately 800 feet in width and centered on Spears Creek, is classified as Palustrine Forested Wetland by the U.S. Fish and Wildlife Service (U.S. Department of Interior). Southwest of the Site, a tributary of Colonel's Creek is present about 1700 feet from the property line, but no overland flow to this tributary is evident.

2.4 Geologic and Hydrogeologic Setting

The Upper Coastal Plain province is underlain by a seaward-dipping wedge of unconsolidated sediments overlying crystalline bedrock. The sandy surface soils (the Lakeland and Kershaw soil series) were formed from Tertiary marine and eolian (wind-deposited) sands. These soils are typically gray to white and give the surrounding White Sand Hills region its name.

Underlying these soils is the upper Cretaceous Middendorf Formation (previously designated the Tuscaloosa Formation). The Middendorf consists of sands and kaolinitic clays representing fluvial and deltaic geologic environments. Subsurface structures present in these sediments include stream channels, overbank deposits, channel scours and fills, and floodplain deposits. Locally, such structures may control groundwater flow patterns. The formation is approximately 200 feet thick in the area of the Site.

Sand strata within the Middendorf are productive aquifers, and the formation serves as a major aquifer in South Carolina. Yields of 10 to 25 gallons per minute (gpm) from wells screened at depths of 50-100 feet, and up to several hundred gpm from those screened from 150-200 feet, are obtained in the Fort Jackson area. Groundwater in both the surficial Tertiary deposits and the Middendorf formation is classified by EPA as Class IIA and by South Carolina as Class GB.

2.5 Site-Specific Geology and Hydrogeology

Boring logs from the Remedial Investigation and from past investigations have been used to develop an understanding of Site

geology. Based on stratigraphic and hydrogeologic characteristics, sediments underlying the Site can be divided into three units:

Unit I is exposed at the surface and consists of interbedded and alternating layers of sand, silty or clayey sand, and silt or clay lenses. These various strata are apparently hydraulically connected. Groundwater occurrence and movement in Unit I is controlled by the types of sediment strata present, and their configuration. Perched water zones occur within the upper part of Unit I; for example, water level data from well MW-25 indicate that this well is screened in a perched water zone.

Detailed cross sections based on the numerous RI well borings (see RI Report) indicated the presence of three sand layers or "lobes." Most Site wells are in the upper and middle sand lobes.

Unit II is a low-permeability confining unit consisting of hard, dry, kaolinitic silty clays or clayey silt. Unit II appears to be laterally continuous on the Site property. Subsurface borings to date have not resulted in the identification of any locations where Unit II is absent; however, in the off site areas it occurs deeper (approximately 75 feet below ground surface) than onsite.

Unit III consists of slightly silty, fine- to medium-grained sand. Because only a few Site well borings have penetrated into Unit III, its hydrogeologic and stratigraphic characteristics are not as well known.

The lower portion of unit I, and all of units II and III, are part of the Middendorf Formation. It is important to note that the simple, general outline of units I-III given above is not meant to infer that simple patterns of groundwater flow and occurrence are present. Viewed as a whole, the subsurface arrangement of various sediment lenses and layers, having different grain sizes and hydrologic properties, creates a complex geometry and greatly complicates attempts to determine contaminant distribution or to model groundwater flow patterns.

2.6 Demography and Land Use

Census data (1990) indicate that 10,220 people reside within a three-mile radius of the Site. However, the great majority of this population resides west of the Site closer to Columbia. Site reconnaisance indicates that only a few homes or businesses are present within 1/2 mile of the Site. Pontiac Elementary School is located some 300 feet north of the Site property line on SC Road

53. The nearest homes and businesses are located across 1-20 to the southeast, along Spears Creek Church Road, 1,200 feet from the plant building. These 8 homes and businesses have private water wells serving 61 people. These are the only wells within a 1/2 mile radius; none are hydraulically downgradient of the Site. The nearest private water wells which are in the direction of groundwater movement are 23 wells which belong to homeowners whose properties surround Woodcreek Lake. The nearest of these is 5,400 feet northeast of the property boundary. The nearest community water well is located 5600 feet east of the Site (south of I-20). All of these distances are approximate.

Figure 4 illustrates the ownership and land use of nearby properties. The site (facility) property is zoned "light industrial." The present Site owner, as well as the county planning authority, foresee continued use of the Site for industrial purposes. Although not shown on the figure, along SC Road 53 in the offsite area there is a strip of property zoned "commercial." Behind this strip, a housing development is planned which will involve most of the offsite parcel of land. However, homesites are not planned in areas along the tributary or near the area of contaminated groundwater. While many areas nearby remain zoned "rural," Richland County expects the northeastern portion of the county to experience significant growth through 2005.

3.0 SITE HISTORY

3.1 Site Operations

In 1964, Dictaphone Corporation purchased an approximately 100-acre parcel of land, which eventually became the Site, and constructed a small manufacturing facility to be used primarily for the assembly of certain models of the company's line of office recording equipment. Details of the operations used are unavailable, but two permits issued by the State of South Carolina indicate that wastewaters generated onsite contained low levels of zinc, cyanide, chromium (chromate ion) and residues from acid and alkali cleaning. Operations on site were permitted for the period between June 1966 and June 1971.

Townsend Saw Chain Company purchased the Site in June of 1971. Their operations onsite began in July 1972. From that time to the present, the main operation of the facility has been the manufacture and assembly of saw chains for chain saws. Processes which comprise this overall operation include metal punch-pressing, metal plating (chromium), heat treatment (heat quench bath), a

<IMG SRC 97109F>

rust-preventative bath, and metal parts cleaning and finishing. Wastewaters produced by these processes contained chromium, cadmium, cyanide, nitrite and nitrate salts, and several volatile organic compounds (VOCs).

Between 1966 and 1981, under both Dictaphone and Townsend Saw Chain Company (later Textron), waste rinsewaters produced during the metals-plating and other processes described above, were disposed of by direct discharge to the ground surface in the low-lying "waste pond" areas adjacent to the facility on the north side. These discharges, which occurred over a period of approximately 15 years, are the origin of the onsite groundwater contamination.

In 1982, after SCDHEC investigated the site, Textron was cited by the State for violations of the established wastewater treatment rules. Investigations since 1982 have confirmed the presence of chromium, other metals, nitrate, and VOCs, in both onsite and offsite groundwater, at levels above the Federal Safe Drinking Water Act of 1974 (SDWA) Maximum Contaminant Levels (MCLs).

3.2 Enforcement, Investigation and Remediation

Since 1982, SCDHEC has continued to oversee Textron's remediation program for groundwater. In 1982, as required by a Consent Order, a groundwater treatment system was installed, consisting of five extraction (pumping) wells, chemical treatment tanks, and a spray or irrigation field for disposal of the treated water. Two pumping wells were located within the former wastewater ponds area with the remaining three wells positioned in a line along SC Road 53. This system operated until 1995. After treatment to the then-applicable South Carolina groundwater quality standard for chromium (0.050 mg/l), groundwater was then discharged to a spray field. Performance of the system and conditions at the spray field have been monitored by SCDHEC under an industrial wastewater permit.

Between 1985 and 1988, SCDHEC and EPA took the necessary steps to list the Site on the National Priorities List (NPL), which places it in the Superfund program. A 1985 Preliminary Assessment/Site Inspection (PA/SI) by SCDHEC revealed elevated or above -background concentrations of chromium, lead, cadmium, arsenic, cyanide, nickel, and four VOCs in groundwater at the site. Chromium, lead, cadmium and arsenic were present at elevated levels in sediments within the waste pond area, and a stream water sample taken just across Spears Creek Church Road north of the site contained chromium and four VOCs. Based on these results, the Site was then ranked by EPA in 1987 using the Hazard Ranking System (HRS), which

evaluates the potential for public exposure to site contamination. Because of the potential for migration of groundwater contaminants offsite, and the large number of people in the surrounding area served by water wells, the Site was assigned an HRS score of 35.94 and was proposed for listing on the NPL in June 1988. The Site was finalized on the NPL in February 1990.

In 1987, SCDHEC identified problems in the 1982 pump-and-treat system's design and performance. To address those deficiencies, a 1988 modification to the 1982 Court Order directed Textron to further investigate and define the extent of groundwater contamination, and to investigate Site hydrogeology as necessary to modify the system's design. A report with design revisions was submitted to SCDHEC in 1990, and following SCDHEC review, again in December 1991. A final permit to construct the system was issued in December 1993.

In October 1991, EPA and Homelite signed an Administrative Order on Consent under which Textron agreed to conduct an RI/FS at the Site. Dictaphone Corporation was named as a Potentially Responsible Party (PRP) by EPA when the Agency notified both Textron and Dictaphone (Pitney-Bowes) that an RI/FS was required under CERCLA. Textron has voluntarily undertaken all Superfund investigation and remediation activities to date.

Textron retained Aquaterra Environmental Consultants, Inc. to perform the RI. RI field work began in early May 1992. The initial effort (referred to as "Phase V, in the Administrative Record) was followed by further investigation of Site groundwater and soils ("Phase II"). Combined Phase I and II activities included the installation and addition of 15 new monitoring wells to the previous monitoring well network. In total, RI sampling included collection and laboratory analysis of approximately 200 samples of surface and subsurface soils, groundwater, stream (surface) water, sediment, and air. Between January and July 1993, at the end of Phase II work, three rounds of offsite shallow groundwater sampling were performed. These 49 off site groundwater samples suggested that the plume of contaminated groundwater was moving offsite, continuing to enlarge, and potentially threatening downgradient private water wells.

After discussions with SCDHEC and Textron in July 1993, EPA decided to move forward with an Interim Remedial Action at the Site. A public meeting was held in late August 1993, at Pontiac Elementary School, to discuss the proposed Interim Action and solicit public comment. An Interim Record of Decision (ROD) requiring Textron to take actions to prevent the continued offsite northeastward

migration of contaminated groundwater was issued by EPA in December 1993. EPA then issued a Unilateral Administrative Order for implementing the Interim Remedial Action (the "Interim Action") to Textron in May 1994. Textron voluntarily agreed to do all of the work outlined in the UAO requirements.

During the summer of 1994 Textron retained SECOR International, Inc., to perform the environmental activities comprising the Interim Action. The first step of the work involved a focused hydrogeologic study in the area northeast of Spears Creek Church Road (the offsite area). After SECOR's work plans for the hydrogeologic study and the Interim Remedial Action were approved by EPA, field work began in August 1994 and was completed in November 1994. A report ("Results of the Offsite Hydrogeologic Study") summarizing the study findings, and serving as a general basis for planning the offsite "Interim Action pump-and-treat system" (or "IAPTS"), was submitted to EPA in January 1995.

Between June and December 1995, the Interim Action pump-and-treat system was constructed and new treatment equipment installed in the wastewater treatment system. The system consists of the three previously-used recovery wells located along SC Road 53, and two new recovery wells located in the offsite area. Groundwater from these wells is pumped to a treatment facility at the plant, and treated in electrochemical precipitation cells. The material precipitated within the treatment cells during treatment is a potentially hazardous sludge, and is therefore handled and disposed of offsite in accordance with EPA and State regulations for handling hazardous wastes. Treated groundwater is then discharged to an onsite SCDHEC-permitted sprayfield. Captured groundwater is not treated for VOCs or nitrate, based on weighted-average calculations (presented in the Interim Remedial Action design) which documented below-MCL concentrations of these contaminants in the system-collected (influent) water. Full operations of the groundwater pump-and-treat system began in December 1995. As a result of EPA-SCDHEC coordination, this system fulfills both the 1993 State permit and EPA's 1994 Unilateral Administrative Order. Data collected to date indicate that the system is capturing affected groundwater in the off site area. The system does not treat any plant process wastewater as the previous system did, since the plant converted in 1995 to a 100% water-reuse system that generates dewatered sludge but no wastewater.

In October 1995 EPA approved the final Remedial Investigation Report prepared by Aquaterra. During late 1994 and early 1995, SECOR completed work on a number of feasibility issues described in the FS, including (1) conducting a pilot-scale demonstration study

of insitu chromium reduction, (2) determination of a leaching-based remediation (cleanup) level, (3) further sampling of sediment at the seep and nearby locations, and (4) completing an Addendum to the Baseline Risk Assessment, which was originally completed in 1993 by an EPA contractor. These issues and results are discussed in the FS, which was approved by EPA in September 1996.

4.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Since the September 1991 announcement of the signing of an Administrative Order on Consent to initiate an RI/FS at the Site, EPA has maintained periodic contact with area residents through the use of fact sheets, public notices, meetings, correspondence, and telephone contact. The mailing list for the Site includes more than 600 individuals and households.

In April 1992, at the time of the completion of the RI work plans, EPA established an information repository at the closest public library, which is the Richland County Northeast Branch Library in eastern portion of the city of Columbia. Materials placed at the repository at that time included background information on Superfund and on the Site. In December 1992 the Administrative Record (AR) for the Townsend Saw Chain Site was established. Upon EPA approval, the RI/FS work plans were then added to the AR.

An RI "kickoff" public meeting was held by EPA at Pontiac Elementary School on April 22, 1992. Approximately 70 persons attended this meeting. Public questions and concerns centered around the proximity of the Site to Pontiac Elementary School, and the long period of groundwater cleanup that had been ongoing without completion of the cleanup effort. EPA staff explained the lack of any health threats to school children based on then-current knowledge of the Site, and that the RI work included verifying the absence of any such threats. EPA and SCDHEC officials also explained the specific details of Homelite-Textron's groundwater remediation activities, and EPA's plans and objectives concerning groundwater contamination.

During the summer of 1993, after completion of RI Phase II field work, EPA determined that an Interim Remedial Action to address offsite groundwater contamination was warranted in view of inconclusive data concerning the full downgradient, offsite extent of Site-affected groundwater, and the likelihood of continuing off site migration of contaminated groundwater. On August 18, 1993, a focused Feasibility Study document entitled "Technical

Memorandum on Interim Remedial Action, which described the proposed action, was placed at the information repository. EPA prepared an August 1993 Proposed Plan Fact Sheet to publicly propose the Interim Remedial Action and to solicit public comments. The fact sheet also announced the opening of a 30-day public comment period on August 20, 1993. A notice to area citizens announcing the August 31, 1993, Proposed Plan public meeting and the public comment period was published in Columbia's daily newspaper, The State, on August 20, 1993.

An Interim Action Proposed Plan public meeting was held to present the Interim Remedial Action Proposed Plan to the public on August 31, 1993, at Pontiac Elementary School. Approximately 70 persons attended the meeting. EPA officials explained that the Interim Action consisted of a hydrogeologic study in the offsite area to define the extent of contamination, followed by expedited design and construction of an extraction and treatment system to capture and treat the affected groundwater and prevent continued offsite movement. As detailed in the Responsiveness Summary of the December 1993 Interim Record of Decision, the public expressed a great deal of interest in the Interim Remedial Action. Most questions concerned EPA's planned precautionary sampling of four private water wells at the southwest end of Woodcreek Lake. In response to these concerns, water wells belonging to a group of residents belonging to the homeowners, group were sampled in September 1993 and again in July 1994 in joint EPA-SCDHEC efforts. Also as a precaution, Textron sampled 7 private wells located along the south side of Interstate Highway 20 although not in the known direction of groundwater movement. Sample results from the 1-20 and Woodcreek Lake wells have indicated, in all cases, non-detects or far below the MCLs for inorganics (such as chromium) and VOCs.

A notice publicizing the issuance of the Interim Record of Decision was published in The State in May of 1994. Throughout 1994 and 1995, EPA maintained ongoing contact with the local homeowners' group (at Woodcreek Lake), as well as the business partnership which owns all of the affected offsite property. "Update Letters" were sent to the president of the homeowners, group in December 1993, September 1994, and September 1995, describing progress and activities at the Site. In October 1994 and again in October 1995, in response to requests for assistance from the partnership in dealing with lending institutions, EPA provided letters to the partnership clarifying the Site's status and describing the ongoing work under both the RI/FS and the Interim Remedial Action.

As announced in an April 1995 fact sheet, EPA held a public meeting on April 27, 1995, to update local residents and the public

concerning the results of the offsite hydrogeology work and plans for the offsite pump-and-treat system. Attendance at this meeting was very light and no significant concerns were expressed.

In July 1996, prior to finalizing the FS, EPA issued a fact sheet describing the technologies and remedial alternatives for final cleanup of the Site. The fact sheet also requested public input on the alternatives and initial evaluation of them. After finalization of the FS, a Proposed Plan Fact Sheet was issued in early September 1996 describing EPA's selected remedy and announcing a September 17, 1996 public meeting. Attendance at this meeting was very small and no concerns about the proposed action were expressed.

5.0 SCOPE AND ROLE OF THE REMEDIAL ACTION WITHIN SITE STRATEGY

The scope of this remedial action, which is described more fully in section 10 of this ROD, includes (1) source control, to prevent leaching of chromium to groundwater, (2) remediation of groundwater, (3) remediation of surface water, and (4) remedial action to address sediment contamination.

This remedial action is the final action (remedy) for this Site. It addresses the principal threat posed by the Site, which is contamination of groundwater. It also addresses contamination in other media. The selected alternative utilizes an innovative treatment technology referred to herein as "insitu chemical treatment", to immobilize chromium by changing it to its less-toxic trivalent state. This removes the toxicity of the chromium, and reduces the volume of the affected groundwater. Additionally, through continued operation of the Interim Action pump-and-treat system, which is part of this remedy, the mobility and volume of contaminated groundwater will be reduced. Therefore, this remedy meets the statutory preference for remedial alternatives which reduce the toxicity, mobility or volume of contamination.

6.0 SUMMARY OF SITE CHARACTERISTICS

6.1 Sources of Contamination

Contamination of soil, groundwater, surface water and sediment occurred as a result of past wastewater disposal operations at the Site. Investigation of potential air contamination during the RI indicated that air emissions are not of concern at the Site. No other sources of contamination were identified during the RI/FS or the Interim Remedial Action. Section 6.2 below details the nature and extent of onsite and offsite contamination.

Hexavalent and trivalent chromium is present in former wastewater ponds area soils just north of the plant building (refer to Figure 4). The former wastewater ponds area forms a low-lying, hourglass-shaped basin into which process wastewaters were discharged between 1966 and 1981. In addition to contaminating surface and subsurface soil, these wastewaters were the source of Site groundwater contamination.

During excavation work for the new groundwater treatment equipment building early in the RI, an abandoned 4-inch clay tile pipeline was uncovered near the northwest corner of the building, which had apparently been used to convey wastewater to the low-lying area. Resultant soil contamination by several metals was present at one small area along the former location of this wastewater pipeline.

Just north of the building, a drainage pipe and associated ditch continuing about 75 feet beyond it, was also located early in the RI, which apparently carried water from floor drains of some of the interior shop areas and possibly process wastewaters. Soil in a small area around this ditch contained elevated levels of metals. The distribution of nitrates in groundwater indicates a likely origin in wastewaters discharged to the ground in this area.

Offsite groundwater contamination reflects the migration of Site contaminated groundwater, toward hydraulically downgradient, topographically lower areas northeast of the Site. No other Site related sources of groundwater contamination have been identified to date in the offsite areas, although the possibility cannot be ruled out. The chromium distribution strongly indicates that it migrated from the former wastewater ponds, northeastward across SC Road 53. VOC detections at MW-l and MW-3 suggest that their origin is at least partially from the former septic tank located beside the main parking lot (east end of building).

Surface water and sediment in the unnamed offsite tributary to Spears Creek exhibit contamination transported by Site-originated chromium-bearing groundwater.

6.2 Nature and Extent of Contamination

Environmental contamination at the Site can be summarized as follows:

- Groundwater onsite and in a portion of the offsite area exhibits greatly elevated concentrations of chromium and sporadic, inconsistent detections of VOCs;
- Surface soil in two small "hotspots" on the plant property contained chromium, cadmium, lead and cyanide at elevated levels;
- Surface soil in the former wastewater ponds area contains elevated levels of hexavalent and trivalent chromium;
- Surface water in the unnamed offsite tributary contains above background levels of chromium; and,
- Sediment in the unnamed offsite tributary contains elevated levels of chromium.

6.2.1 Groundwater

The RI verified that Unit I groundwater onsite and in the offsite area is impacted primarily by elevated concentrations of hexavalent chromium. Detected concentrations ranged up to 3.11 mg/l total chromium. Table 1 details RI sampling results for inorganic contaminants (metals), with the wells grouped by geologic unit. VOCs were also detected at a number of wells, at individual VOC concentrations ranging from the detection limit (1.0 micrograms per liter, or ug/l) to 110 ug/l. The primary VOC contaminants are trichloroethylene and tetrachloroethylene; other detections of related daughter compounds were generally less than 20 ug/l. There were detections of acetone and propanol; the absence of these in later post-RI sampling (1994-1996) suggests they represented laboratory contamination. Organic contaminant concentrations from the RI are presented in Table 2. The locations of the RI monitor wells are shown in Figure 5.

During the Interim Remedial Action field work (the "Offsite Hydrogeologic Study"), a geochemical comparison was performed which indicated that almost all chromium in the aquifer occurs in the hexavalent form. More recent sampling events continue to show a chromium groundwater contaminant plume as shown in Figure 6, with recurring but inconsistent detections of trace VOCs. Table 3 lists the March (first quarter) 1996 analytical results from the quarterly IAPTS sampling event, upon which Figure 6 was based.

As presented in the FS, the volume of chromium-impacted groundwater is estimated to be approximately 26,200,000 gallons. The volume of nitrate-impacted groundwater is much smaller, estimated at

TABLE 1
RI GROUNDWATER SAMPLING RESULTS (Inorganics)

(TAL - Total Inorganics Results for Unit I Monitoring Wells).

Parameter	MW-1	MW-2	MW-3	MW-4A	MW-4A (Dup)	MW-4B	MW-5
	06/11/92	06/11/92	06/11/92	06/09/92	06/09/92	06/11/92	06/10/92
Aluminum	282	1120	12100	139	124	173	438
Antimony	12 U	12 U	12 U	12 U	12 U	12 U	12 U
Arsenic	1 U	1 U	1.8 B	10 U	10 U	1.7 B	1 U
Barium	142	151	46.1	18.8	18.9	18.6	6.9
Beryllium	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	1.6 B	1 U	1 U	1 U	1 U	1 U	1 U
Calcium	3350	2630	612	564	616	1800	1510
Chromium	5 U	5 U	19.3	1160	1180	658	5 U
Cobalt	2 U	2 U	2 U	4.2 B	4.5 B	4.5 B	2 U
Copper	4 U	4 U	5 B	4.1 B	2.4 B	4 U	4 U
Iron	162	675	6320	227	165	221	246

Lead	2.1	17.4	6.2	1.2 B	1.3 B	5.3	1.3 B
Magnesium	2130	2960	686	451	429	444	133
Manganese	42.9	28.6	23.3	4.5	3.7	6.2	2.6 B
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	7 U	.7 U	8.1 B	5.1 B	7 B	7 U	7 U
Potassium	2990 B	2920 B	756 B	1620 B	1640 B	206 B	313 B
Selenium	1 U	1 U	1 U	3.2 U	3.2	3.4	1 U
Silver	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Sodium	32500	1500	1840	77400	78300	65100	729 B
Thallium	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vanadium	2 U	3.4 B	21.9	2 U	2 U	2 U	2 U
Zinc	35.2	62.8	42	52.6	67.8	47.2	39.9
Cyanide	10 U	10 U	10 U	24.9	35.2	10 U	10 U
Nitrate	14.4	18	0.7	10.2	10.2	5.6	0.62
Nitrite	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Chromium, hex						NA	
Sulfate						NA	

Result units are µg/L exceptfor nitrate/nitrite, Kjeldahl nitrogen, and sulfate which are mg/L.
U - The analyte was analyzed for but not detected at or above the IDL.
B - The reported value is less than the Contract Required Detection Limit (CRDL).
but greater than or equal to the Instrument Detection Limit (IDL).

TABLE 1 (cont'd)
RI GROUNDWATER SAMPLING RESULTS (Inorganics)

Parameter	MW-6 06/10/92		MW-7 06/08/92		MW-7(Dup 06/08/92		MW-8 06/11/92		MW-9 06/10/92		MW-10A 06/11/92	
Aluminum	4320		605		1280		2820		26200		12400	
Antimony	12	U	12	U	12	U	12	U	12	U	12	U
Arsenic	1	U	1	U	1	U	1	U	1	U	2.4	B
Barium	10.4		7.1		7.8		70.4		94.2		20.4	
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	1	U	1	U	1	U	9		2.3	B	1	U
Calcium	578		360		274		8830		6150		772	
Chromium	37.1		100		101		5	U	82.9		541	
Cobalt	2	U	2	U	2	U	4.5	B	4.1	B	9.4	
Copper	4	U	4	B	5.7	B	4	U	26.2		8.8	B
Iron	1240		442		462		1920		57000		9790	
Lead	8.2		4.5		2.8		4.4		21.2		6.7	
Magnesium	110	B	135		155		1480		1910		293	
Manganese	7.8		4.1		3.7		59.7		213		16.8	
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.24		0.4	
Nickel	7	U	4.9	B	4	U	7	U	19.1	B	9.1	B
Potassium	318	B	237	B	271	B	6880		3580	B	497	B
Selenium	1	U	1.5	B	1.5	B	1	U	1	U	4.6	
Silver	3	U	3	U	3	U	3	U	3	U	3	U
Sodium	4750		17600		17100		18500		4960		125000	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8.5		2	U	2.8	B	8.3		209		46.1	
Zinc	32		38.5		29.2		60		95.4		96.9	
Cyanide	10	U	10	U	10	U	10	U	10	U	77.1	
Nitrate	0.59		1.5		1.7		14.1		1.8		15.1	
Nitrite	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.04	
Kjeldahl	NA		NA		NA		1.3		NA		NA	
Chromium, hex												
Sulfate												

Result units are µg/L except for nitrate/nitrite, Kjeldahl nitrogen, and sulfate which are mg/L.
U - The analyte was analyzed for but not detected at or above the IDL
B - The reported value is less than the Contract Required Detection Limit (CRDL).
but greater than or equal to the Instrument Detection Limit (IDL).
NA - Compound not analyzed

TABLE 1 (cont'd)
RI GROUNDWATER SAMPLING RESULTS (Inorganics)

Parameter	MW-10A	MW-11	MW-12	MW-13	MW-14	MW-16	MW-19

	10/08/92		06/08/92		06/08/92		06/08/92		06/10/92		06/09/92		06/15/92	
Aluminum	13600		15600		10800		1770		42700		924		3250	
Antimony	12	U	12	U	12	U	12	U	12	U	12	U	12	U
Arsenic	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Barium	18.3		20.2		156		23.2		62.7		8.9		9.6	
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	1	U	2.5	B	1	U	1	U	1	U	1	U	1	U
Calcium	1580		15800		44200		2630		1100		329		376	
Chromium	459		13		33		6.5		63.1		5	U	5	U
Cobalt	10.9		8.2		5.1		2	U	2.5	B	2	U	2	U
Copper	11.1		2	U	13.2		4.6	B	17.6		4.1	B	4	U
Iron	12300		3000		8740		1890		22300		447		1200	
Lead	8		7.1		10		11.9		8.2		10.8		2.9	
Magnesium	321		11200		5080		544		749		202		135	
Manganese	18.5		182		230		67.9		40.5		3.2		4.7	
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	1.3		0.2	U	0.24	
Nickel	7	U	5.4	B	12.9	B	4	U	21.3	B	4	U	7	U
Potassium	561	B	91000		136000		850	B	3930		231	B	219	B
Selenium	6		39		10	U	2.1	B	1	U	1.5	B	1	U
Silver	3	U	1	U	3	U	3	U	3	U	3	U	3	U
Sodium	127000		452000		20000		14500		12200		7950		3920	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	57.2		13.1		47		4.4	B	94.6		3	B	8.7	
Zinc	29.4		209		136		47.1		81.4		36.3		35	
Cyanide	91.9		10.1		10	U	10	U	10	U	10	U	10	U
Nitrate	8.6		7.4		2.3		2.2		0.85		1.4		0.86	
Nitrite	0.03		0.02	U	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
Kjeldahl	NA		NA		NA		NA		NA		NA		NA	
Chromium, hex	NA		NA		NA		NA		NA		NA			
Sulfate														

Result units are µg/L except for nitrate/nitrite, Kjeldahl nitrogen, and sulfate which are mg/L.
U - The analyte was analyzed for but not detected at or above the IDL.
B - The reported value is less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).
NA - Compound not analyzed

TABLE 1 (cont'd)
RI GROUNDWATER SAMPLING RESULTS (Inorganics)

Parameter	MW-21	MW-22	MW-25	MW-28	MW-30

MW-33A

	06/09/92	06/09/92	06/10/92	06/10/92	06/10/92	06/09/92	08/18/92
Aluminum	4550	1930	20400	3050	2900	905	526
Antimony	12 U	12 U	12 U	12 U	12 U	12 U	12 U
Arsenic	1 U	10 U	10 U	1 U	1 U	10 U	10 U
Barium	38.1	26.3	244	6.6	9.9	17.5	15.5
Beryllium	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Calcium	333	8480	486	605	900	381	517
Chromium	2740	5 U	1390	112	22.4	3110	2680
Cobalt	7	2 U	15.7	2 U	2 U	3.4 B	5.6
Copper	8.7 B	2.3 B	21.3	4 U	4 U	5.8 B	5.2 B
Iron	3490	858	21300	2740	1960	3680	1330
Lead	8.7	4.8	8.7	3.5	3	8.8	4.5
Magnesium	425	129000	1240	93.9 B	237	248	218
Manganese	6	78.6	28.6	5.9	5.1	6.2	6.4
Mercury	0.2 U	0.2 U	2.4	0.2 U	0.22	0.42	0.67
Nickel	30.7 B	4 U	72.5	7 U	7 U	8.3 B	7 U
Potassium	551 B	2780 B	1290 B	226 B	362 B	2920 B	2510 B
Selenium	1.3 B	15 B	1.3 B	1 U	1 B	6.4	4.6
Silver	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Sodium	224000	199000	289000	11400	16900	90700	84700
Thallium	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vanadium	18.6	7.7	70.4	9.5	12.9	7.6	4.8 B
Zinc	105	87.6	146	59	52	85.4	97.8
Cyanide	156	10 U	418	10 U	10 U	19.6	10 U
Nitrate	6.5	3.6	11.9	0.96	2.4	13.9	15.7

Nitrite	0.02 U	0.02 U	0.16	0.02 U	0.02 U	0.02 U	0.2 U
Kjeldahl	NA	NA	4.6	NA	NA	NA	NA
Chromium, hex	NA	NA	NA	NA	NA	50 U	NA
Sulfate							

Result units are µg/L except for nitrate/nitrite, Kjeldahl nitrogen, and sulfate which are mg/L.
U - The analyte was analyzed for but not detected at or above the IDL.
B - The reported value is less than the Contract Required Detection Limit (CRDL).
but greater than or equal to the Instrument Detection Limit (IDL).
NA - Compound not analyzed

TABLE 1 (cont'd)
RI GROUNDWATER SAMPLING RESULTS (Inorganics)

Parameter	MW-34A	MW-35A		MW-35B			MW-36
	10/07/92	06/15/92	10/07/92	06/16/92	08/04/92	10/07/92	10/08/92
Aluminum	13600	1070	832	48100	17100	4880	11000
Antimony	12 U	12 U	12 U	12.6 B	12 U	12 U	
Arsenic	1.5 B	1 U	1 U	2.2 B	1 U	1 U	3.1
Barium	27.8	25.4	25.7	84.7	108	47.5	22.6
Beryllium	1 U	1 U	1 U	1.7	1 U	1 U	1 U
Cadmium	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Calcium	461	991	547	7270	6950	2630	715
Chromium	472	2000	2030	425	723	711	16.6
Cobalt	2.4 B	2.8 B	5.1	3.8 B	6.2	5.2	2.2 B
Copper	8 B	4 U	4 U	30.8	31.2	16.4	9.9
Iron	10500	421	714	27500	27300	6940	7970
Lead	7.7	1 U	1.9 B	8.6	18	6.6	13.8
Magnesium	331	498	516	3180	3180	1340	475
Manganese	33.4	6.8	7.3	133	120	33	27.1
Mercury	0.46	0.2 U	1.6	0.24	0.26	0.23	0.2 U

Parameter							
Nickel	7 U	7 U	7 U	18.6 B	8.7 B	7 U	7 U
Potassium	566 B	2760 B	2830 B	2720 B	3030 B	1620 B	340 B
Selenium	1.3 B	1 U	1 U	1 U	1 U	1 U	1 U
Silver	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Sodium	36600	30600	33800	35700	32400	32800	2960
Thallium	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vanadium	36.7	2.4 B	3.4 B	179	280	75.4	16.4
Zinc	33.5	95.7	26.4	115	112	25.1	42.7
Cyanide	10 U	10 U	10 U	10 U	NA	11.7	10 U
Nitrate	4.7	8.7	9.5	7.5	NA	8.1	1.1
Nitrite	0.02 U	0.02 U	0.02	0.02	NA	0.02 U	0.04
Kjeldahl	NA	NA	NA				NA
Chromium, hex	NA	NA	NA	NA	NA	NA	NA
Sulfate				NA	NA	NA	

Result units are µg/L except for nitrate/nitrite, Kjeldahl nitrogen, and sulfate which are mg/L.
U - The analyte was analyzed for but not detected at or above the IDL.
B - The reported value is less than the Contract Required Detection Limit (CRDL),
but greater than or equal to the Instrument Detection Limit (IDL).
NA - Compound not analyzed

TABLE 1 (cont'd)
RI GROUNDWATER SAMPLING RESULTS (Inorganics)

Parameter	MW-37			MW-38			MW-39A
	06/16/92	08/04/92	10/08/92	06/16/92	08/04/92	10/08/92	09/07/93
Aluminum	89500	57000	19100	108000	NA	24300	4910
Antimony	12.2 B	12 U	12 U	19.8 B	NA	12 U	35 U
Arsenic	6.3	3.4	2.3 B	18 B	NA	1.4 B	2 B

Barium	178	127	50.5	232	NA	83.5	15.9
Beryllium	2.6	2.2	1 U	7.2	NA	1 U	1 U
Cadmium	1 U	1 U	1 U	1 U	NA	1 U	3 U
Calcium	20600	13700	6510	46400	NA	9240	1990
Chromium	148	98.8	29.4	358	NA	806	11
Cobalt	12.8	9.3	3.6 B	11.4	NA	7.1	4 U
Copper	125	106	54	156	NA	41.3	9.6
Iron	65100	45400	14500	59200	NA	14200	2720
Lead	34.6	18	12.2	79.5	NA	19.1	4.4
Magnesium	6270	4450	1570	14800	NA	3100	230
Manganese	906	533	155	741	NA	197	6.3
Mercury	0.31	0.27	0.2 U	0.93	0.38	0.2 U	0.21 B
Nickel	65.4	39.8	20.8 B	56.8	NA	10.6 B	8 U
Potassium	3110 B	2360 B	1050 B	5380	NA	1810 B	517 B
Selenium	10 U	1 U	1 U	10 U	NA	1 U	2 U
Silver	3 U	3 U	3 U	3 U	NA	3 U	3 U
Sodium	25900	17500	7650	101000	NA	68700	1790
Thallium	1 U	1 U	1 U	1 U	NA	1 U	9.4
Vanadium	366	257	80.2	265	NA	76.6	8.9
Zinc	199	174	66.2	282	NA	78.6	11.7
Cyanide	10 U	NA	10 U	14.9	NA	12.9	4 B
Nitrate	0.84	NA	1.4	7.6	NA	1.9	0.13
Nitrite	0.02 U	NA	0.05	0.03	NA	0.02 U	0.02 U
Kjeldahl	NA	NA	NA	NA	NA	NA	NA
Chromium, hex	NA	NA	NA	NA	NA	NA	0.01 U
Sulfate							1 U

Result units are in µg/L except for nitrate/nitrite, Kjeldahl nitrogen, and sulfate which are

mg/L.
U - The analyte was analyzed for but not detected at or above the IDL.
B - The reported value is less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).
NA - Compound not analyzed

TABLE 1 (cont'd)
RI GROUNDWATER SAMPLING RESULTS (Inorganics)

Parameter	MW - 40A	MW - 41A	MW - 41B	MW - 42A		MW - 42B
	09/08/93	09/09/93	09/08/93	08/26/93	09/10/93	09/08/93
Aluminum	287	81100	46500	10600	31000	5810
Antimony	35 U	35 U	35	20 U	35 U	35 U
Arsenic	2 U	24.8	12.4	5 U	2 U	3.6
Barium	5.2	139	115	150	131	41.7
Beryllium	1 U	3	2.5	6	1.7	1 U
Cadmium	3 U	3 U	3	5 U	3 U	3 U
Calcium	213	26000	13000	43100	21700	6720
Chromium	4 U	161	314	30	57	14.4
Cobalt	4 U	4 U	5.9	20 U	4 U	4 U
Copper	3 U	34.7	45.1	31	36	11.9
Iron	62.5	62300	53000	5600	28000	3370
Lead	1.3 B	60.8	32.8	8	1 U	9.9
Magnesium	89.4 B	5570	2580	10700	5690	1240
Manganese	2.2 B	438	226	290	551	62.1
Mercury	0.2 U	0.66	0.62	0.2 U	0.27	0.26
Nickel	8 U	43.3	114	20 U	26.4 B	8 U
Potassium	355 B	2240 B	2660	4600	2510 B	794 B
Selenium	2 U	2 U	2	2 U	2 U	2 U
Silver	3 U	3 U	3	10 U	3 U	3 U
Sodium	1400	14600	24300	151000	55300	13300
Thallium	2 U	4.4	7.2	5 U	2 U	2.6 B
Vanadium	2 U	157	356	29	31.8	19.6
Zinc	4.8	203	159	390	183	28.3
Cyanide	3.5 B	2 B	3.5	10 U	3 B	3 B
Nitrate	0.08	2.5	0.48	1.8	0.79	0.5
Nitrite	0.01 U	0.05	0.02	O.04	0.2	0.04
Kjeldahl	NA	NA		NA	NA	
Chromium, hex	0.01 U	0.03	0.01	NA	0.02	0.01 U
Sulfate	1 U	56	7.2	NA	50	14

Result units are in μg/L except For nitrate/nitrite. Kjeldahl nitrogen, and sulfate which are mg/L.
U - The analyte was analyzed for but not detected at or above the IDL.
B - The reported value is less than the Contract Required Detection Limit (CRDL).
but greater than or equal to the Instrument Detection Limit (IDL).

NA - Compound not analyzed

TABLE 1 (cont,d)
RI GROUNDWATER SAMPLING RESULTS (Inorganics)

(TAL - Total Inorganics Results for Unit I Lower Sand Lobe Monitoring Wells).

Parameter	MW - 4B (4A)	MW - 35B (old 35D)			MW - 41B	MW - 42B
	6/11/92	6/16/92	8/4/92	10/7/92	9/8/93	9/8/93
Aluminum	173	48100	17100	4880	46500	5810
Antimony	12 U	12.6 B	12 U	12 U	35 U	36 U
Arsenic	1.7 B	2.2 B	1 U	1 U	12.4	3.6
Barium	18.6	84.7	108	47.5	115	41.7
Beryllium	1 U	1.7	1 U	1 U	2.5	1 U
Cadmium	1 U	1 U	1 U	1 U	3 U	3 U
Calcium	1800	7270	6950	2630	13000	6720
Chromium	658	425	723	711	314	14.4
Cobalt	4.5 B	3.8 B	6.2	5.2	5.9	4 U
Copper	4 U	30.8	31.2	16.4	45.1	11.9
Iron	221	27500	27300	6940	53000	3370
Lead	5.3	8.6	18	6.6	32.8	9.9
Magnesium	444	3180	3180	1340	2580	1240
Manganese	6.2	133	120	33	226	62.1
Mercury	0.2 U	0.24	0.26	0.23	0.62	0.26
Nickel	7 U	18.6 B	8.7 B	7 U	114	8 U
Potassium	206 B	2720 B	3030 B	1620 B	2660 B	794 B
Selenium	3.4	1 U	1 U	1 U	2 U	2 U
Silver	3 U	3 U	3 U	3 U	3 U	3 U
Sodium	65100	35700	32400	32800	24300	13300
Thallium	1 U	1 U	1 U	1 U	7.2	2.6 B
Vanadium	2 U	179	280	75.4	356	19.6
Zinc	47.2	115	112	25.1	159	28.3
Cyanide	10 U	10 U	NA	11.7	3.5 B	3 B
Nitrate	5.6	7.5	NA	8.1	0.48	0.5
Nitrite	0.02 U	0.02	NA	0.02 U	0.02	0.04
Chromium +6	NA	NA	NA	NA	0.01 U	0.01 U
Sulfate	NA	NA	NA	NA	7.2	14

Result units are in ug/L except for nitrate/nitrite/sulfate which are mg/L.
N-4 - Compound not analyed
U - The analyte was analyzed for but not detected at or above the IDL.
B - The reported value is less than the Contract Required Detection Limit (CRDL).
but greater than or equal to the Instrument Detection Limit (IDL).

TABLE 2
GROUNDWATER SAMPLING RESULTS (Organics)
(Volatile Organic Compounds, Unit I Shallow Monitoring Wells.)

Target Compound List	MW-1 6/11/92	MW-2 6/11/92	MW-3 6/11/92	MW-4A 6/9/92	MW-4A 6/9/92 DUP	MW-5 6/10/92	MW-6 6/10/92
Acetone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	2	1 J	0.6 J	2 B	2 B	1 U	1 U
Chloromethane	1 J	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	5	1 U	3	3	1 U	1 U
1,1-Dichloroethene	8	9	1 U	16	15	1 U	1 U
cis-1,2-Dichloroethene	5	6	1 U	2	1 J	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	2 J	2 J	0.8 J	2 U	2 U	2 U	2 U
Tetrachloroethene	18	17	0.5 J	8	7 U	1 U	1 U
Toluene	0.9 J	0.3 J	0.2 J	0.6 JB	0.4 JB	1 U	1 U
1,1,1-Trichloroethane	4	4	1 U	9	8	1 U	1 U
Trichloroethene	85	59	1 J	21	19	1 U	

							1 U
Xylenes (total)	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Decane	0.7 J						
Benzene B Value	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform B Value	1 U	1 U	1 U	0.5 J	0.5 J	1 U	1 U
Toluene B Value	1 U	1 U	1 U	0.8 J	0.8 J	1 U	1 U

Result units are in μg/L
J - Estimated concentration of analyte which is present but at a concentration less than the stated detection limit.
B - Allowable analyte present in the sample's associated Method Blank and/or Instrument Blank.
U - Compound was analyzed but not detected.

TABLE 2 (cont'd)
GROUNDWATER SAMPLING RESULTS (Organics)

Target Compound List	MW-7 6/8/92	MW-7 6/8/92 DUP	MW-8 6/11/92	MW-9 6/10/92	MW-10A 6/11/92	MW-11 6/8/92	MW-12 6/8/92
Acetone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	3 B	3 B	5	1 U	2	0.7 JB	1 U
Chloromethane	1 U	0.7 J	1 U	1 U	1 U	3	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	0.8 J	1 U	1 U
1,1-Dichloroethene	0.6 J	0.6 J	2	2	2	1 U	1 U
cis-1,2-Dichloroethene	1 U	1 U	3	1 U	1 U	1 U	1 U
Ethylbenzene	1 U	0.2 J	1 U	1 U	1 U	1 U	1 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	3	3	11	2 U	5	2 U	2 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	1 U	1 U	14	19	0.6 J	1 U	1 U
Toluene	3	3	6	1 U	2	1 U	1 U
1,1,1-Trichloroethane	3	4	1 J	3	2	0.8 J	1 U

Trichloroethene	1 U	1 U	72 1	2	0.8 J	1 U	1 U
Xylenes (total)	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Unknown Alkane	4 JB	5 JB					
Decane			5 J				
Unknown					3 J		
Benzene B Value	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform B Value	0.1 J	0.1 J	1 U	1 U	1 U	0.1 J	0.1 J
Toluene B Value	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Result units are in ug/L.
J - Estimated concentration of analyte which is present but at a concentration less than the stated detection limit.
B - Allowable analyte present in the sample's associated Method Blank and/or Instrument Blank.
U - Compound was analyzed but not detected.

TABLE 2 (cont'd)
GROUNDWATER SAMPLING RESULTS (Organics)

Target Compound List	MW-13 6/8/92	MW-14 6/10/92	MW-16 6/9/92	MW-19 6/15/92	MW-21 6/9/92	MW-22 6/9/92	MW-25 6/10/92
Acetone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	0.7 J	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	6 B	2	1 U	1 U	0.8 JB	0.3 JB	1 J
Chloromethane	1 U	1 U	l U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	l U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	4
cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	0.4 J	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	10	2 J	2 U	2 U	2 J	2 U	2 J
Tetrachloroethene	1 U	1 U	1 P	1 U	1 U	1 U	0.6 U
Toluene	7	2	1 U	0.6 J	0.7 JB	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	14
Trichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 J
Xylenes (total)	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Unknown	0.7 J			0.5 J	5 J	3 J	1 J
Unknown	0.6 J				2 J		
Unknown	3 J						
Unknown Alkane	7 JB						
Decane		4 J					
Benzene B Value	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform B Value	0.1 J	1 U	0.5 J	1 U	0.5 J	0.5 J	1 U
Toluene B Value	1 U	1 U	0.8 J	1 U	0.8 J	0.8 J	1 U

Result units are in ug/L.
J - Estimated concentration of analyte which is present but at a concentration less than the stated detection limit.
B - Allowable analyte present in the sample's associated Method Blank and/or Instrument Blank.
U - Compound was analyzed but not detected.

TABLE 2 (cont'd)
GROUNDWATER SAMPLING RESULTS (Organics)

Target Compound List	MW-28 6/10/92	MW-30 6/10/92	MW-33A 6/9/92	MW-33A 8/18/92	MW-35A 6/15/92	MW-37 6/16/92	MW-38 6/16/92
Acetone	5 U	5 U	5 U	10 U	5 U	17	5 U
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	10 U	1 U	1 U	2
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	1 U	1 U	3 B	2 J	0.9 J	9	15
Chloromethane	1 J	1 J	1 U	10 U	1 U	0.7 J	1 U
1,1-Dichloroethane	1 U	1 U	14	12	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	18	15	4	1 U	1 U
cis-1,2-Dichloroethene	1 U	1 U	3	10 U	1 J	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	10 U	1 U	0.3 J	1 U

2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	2 U	2 U	0.3 J	10 U	4	6	3
Tetrachloroethene	1 U	1 U	17	14	3	1 U	1 U
Toluene	1 U	0.6 J	1 U	10 U	0.4 J	5	3
1,1,1-Trichloroethane	1 U	1 U	11	9 J	6	1 U	1 U
Trichloroethene	1 U	1 U	35	25	11	0.1 J	1 U
Xylenes (total)	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Benzene B Value	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform B Value	1 U	1 U	0.5 J	1 U	1 U	1 U	1 U
Toluene B Value	1 U	1 U	0.8 J	1 U	1 U	1 U	1 U

Result units are in ug/L.
J - Estimated concentration of analyte which is present but at a concentration less than the stated detection limit.
B - Allowable analyte present in the sample's associated Method Blank and/or Instrument Blank
U - Compound was analyzed but not defected.

TABLE 2 (cont'd)
GROUNDWATER SAMPLING RESULTS (Organics)

Target Compound List	MW-39A 9/7/93	MW-40A 9/8/93	MW-41A 9/9/93	MW-42A 9/9/93
Acetone	5 U	140	540	5 U
Benzene	1 U	1 B	3 B	3 B
Bromodichloromethane	1 U	1 U	1 U	2
Bromoform	1 U	1 U	1 U	1 U
2-Butanone	4 J	5 U	7	5 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U
Chloroform	1 U	1 U	2	15
Chloromethane	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U

Ethylbenzene	1 U	1 U	1 U	1 U
Methylene Chloride	2 U	2 U	2 U	2 U
2-Hexanone	5 U	5 U	2 J	5 U
Styrene	1 U	1 U	0.6 J	0.5 J
Tetrachloroethene	80	78	32	5 U
Toluene	1 U	1 U	1	1
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U
Trichloroethene	2	2	0.8 J	1 U
Xylenes (total)	1	1	0.3 J	1 U
2-Propanol	NI	NI	91 J	NI
Benzene B Value	1 U	2	3	3
Chloroform B Value	1 U	1 U	1 U	1 U
Toluene B Value	1 U	1 U	1 U	1 U

Result units are in ug/L.
J - Estimated concentration of analyte which is present but at a concentration less than the stated detection limit.
B - Allowable analyte present in the sample's associated Method Blank and/or Instrument Blank.
U - Compound was analyzed but not detected.

TABLE 2 (cont,d)
GROUNDWATER SAMPLING RESULTS (Organics)

(Volatile Organic Results for Unit I Lower Sand Lobe Ground Water Monitoring Wells)

Target Compound List	MW-4B 6/11/92	MW-35B 6/16/92	MW-41B 9/8/93	MW-42B 9/8/93
Acetone	5 U	5 U	230	5 U
Benzene	1 U	1 U	2 B	2 B
Bromodichloromethane	1 U	2	1 U	1 U
2-Butanone	5 U	5 U	3 J	5 U
Chloroform	2	13	8	3
Chloromethane	1 J	1 U	1 U	1 U
1,1-Dichloroethene	0.4 J	3	1 U	1 U
cis-1,2-Dichloroethene	1 U	2	1 U	1 U
Methylene Chloride	3	6	2 U	2 U
Tetrachloroethene	1 U	3	110	52
Toluene	3	6	0.9 J	1 U
1,1,1-Trichloroethane	1 U	1 J	1 U	1 U
Trichloroethene	1 U	16	3	1 U

Xylenes (total)	1 U	1 U	2	0.7 J
Tentatively identified Compounds				
Decane	NI	7 J	84 J	NI

Result units are in ug/L.
J - Estimated concentration of analyte which is present but at a concentration less than the stated detection limit.
B - Benzene at 2J NI - None Identified
U - Compound was analzed but not detected.
NA - Compound Not Analyzed.

<IMG SRC 97019G>

<IMG SRC 97918H>

TABLE 3
MARCH 1996 GROUNDWATER SAMPLING RESULTS

Well	Chromium TOTAL (mg/l)	Chromium HEXV (mg/l)	Nitrate (mg/l)	Total VOC (mg/l)
MW-1	<0.010	<0.010	9.29	0.0483
MW-6	0.0188	0.016	0.123	0.0021
MW-10	0.310	0.326	3.81	0.0022 LC
MW-11	0.00936	NA	1.51	BQL
MW-12	0.0053	NA	1.61	0.0046 MX
MW-13	<0.010	0.012 MX	0.366	0.0025
MW-14	0.0155	<0.010	1.61	0.0027
MW-22	<0.010	<0.010	1.63	0.0017
MW-28	0.0466	0.042	0.268	0.003
MW-33	2.250	1.78	8.56	0.0426
MW-35A	0.498	0.516	5.15	0.0149
MW-38	0.513	0.474	0.716	0.021
MW-43	0.014	0.012	0.365	2.4
MW-44	0.0237	NA	0.623	BQL
MW-53	0.139	0.080	3.01	0.0527
MW-54	<0.010 MX	0.032 MX	2.60	0.0491
EW-6	0.826	1.07	2.09	BQL
EW-7	0.155	NA	NA	0.0257

EW-8	4.260	3.88	4.58	0.0226
EW-12	0.880	1.15	5.89	0.0501
EW-13	0.043	0.031	2.05	BQL
SEEP	0.187	0.190	1.91	0.0055

NOTES

NA = Not analyzed for in this sample.
LC = Common labarotary contaminant
BQL = Below quantitation limit, QL = 0.001 mg/l.
MX = This result is from the higher of two samples (duplicate).

approximately 7,400,000 gallons. VOC detections occur sporadically and generally within the chromium plume area; because there is no coherent plume, the VOC-impacted volume cannot be reliably estimated.

6.2.2 Soil

The RI generated a very large amount of tabulated data concerning Site soils. In order to focus on necessary Site remediation, all of the RI data collected will not be repeated here.

In developing the RI work plan in 1992, five possible areas of soil contamination came to light (Figure 3). The amounts of contamination detected in soils at (1) the sprayfield, and (2) the septic tanks and associated leachfields, were not significant, and since there is no significance for remediation, the data are not repeated here. It should be noted that, based on wastewater and wastewater sludge analytical results, Textron had the solid material in both septic tanks removed in 1993.

RI data showed significant soil contamination of lead, chromium, cadmium, and cyanide affecting two small "hotspot" areas near two former point sources: (1) the "drainage ditch/pipe area," and (2) the "four-inch wastewater pipe" area (Figure 3). The soil surrounding the latter area was excavated, tested and disposed of in accordance with RCRA requirements, during construction of a new treatment equipment building in 1993 (in accordance with the State wastewater permit). The drainage ditch area soils have been excavated and removed as part of the Interim Remedial Action and are also not further considered here.

Soil in the former wastewater ponds area was investigated in 1994 and early 1995 in post-RI and Interim Remedial Action activities. Extensive sampling (Table 4) at the locations shown on Figure 7 indicated that small pockets of hexavalent chromium-bearing surface soils remain in this area. A maximum value of 279 mg/kg was detected in one sample although most contained much less. Figure 8 illustrates the distribution of hexavalent chromium in surface soils in the former wastewater ponds area.

6.2.3 Surface Water

Table 5 summarizes surface water data collected at the offsite tributary from the State permit sampling (seep location), RI (1992/1993), and post-RI (1994/1995) activities. In the RI samples, concentrations of contaminants other than chromium were not significant for risk or remediation purposes and thus are not

TABLE 4
WASTEWATER PONDS AREA SOIL SAMPLE RESULTS

Sample ID	Date	Sample Depth (feet)	Total Chromium	Hexavalent Chromium
1	9/22/94	0.5	2	0.44
2	9/22/94	1.0	<0.1	0.52
3	9/22/94	1.0	<0.1	0.42
4	9/22/94	0.5	67	4.69
5	9/22/94	0.5	153	12.18
6	9/22/94	1.0	67	4.52
7	9/22/94	0.5	626	14.43
8	9/22/94	0.5	389	19.26
9	9/22/94	0.5	346	10.02
10	9/22/94	1.0	13	2.94
11	9/22/94	1.0	13	4.19
12	9/22/94	1.0	<0.1	4.52
13	9/22/94	1.0	<0.1	0.44
14	9/22/94	1.0	<0.1	0.44
15	9/22/94	1.0	<.1	0.94
16	9/22/94	0.5	422	15.01
17	9/22/94	0.3	508	34.37
18	9/22/94	0.3	787	61.02
19	9/22/94	0.3	658	31.87
20	9/22/94	0.3	174	18.76
21	9/22/94	0.3	4215	91.83
22	9/22/94	0.3	260	13.01
23	9/22/94	0.3	99	14.18
24	9/22/94	0.3	77	5.19
25	9/23/94	0.3	583	4.69
26	9/23/94	0.3	570	Not Analyzed
27	9/23/94	0.3	171	Not Analyzed

28	9/23/94	0.3	1237	Not Analyzed
29	9/23/94	0.3	1064	Not Analyzed
30	9/23/94	0.3	124	Not Analyzed
31	9/23/94	0.3	1111	Not Analyzed
32	9/23/94	0.2	30832	1.30
33	9/23/94	0.2	16477	209.00
34	9/23/94	0.2	19676	279.00

Units = mg/kg

<IMG SRC 97019I>

<IMG SRC 97019J>

TABLE 5
SURFACE WATER SAMPLE RESULTS

Sample Date	Sample Location	Source	Concentration (µg/L)	Sample Date	Sample Location	Source	Concentration (µg/L)
	Chromium, Total				Chromium, Total		
12/9/82	Seep Location	(1)	120	5/18/92	SW-4 (seep)	(2)	35.7
2/7/83	Seep Location	(1)	140		SW-4 Duplicate	(2)	39.6
3/21/83	Seep Location	(1)	140	9/29/92	SW-1	(2)	63.9
7/19/83	Seep Location	(1)	80		SW-2	(2)	103
10/6/83	Seep Location	(1)	120		SW-3	(2)	164
1/17/84	Seep Location	(1)	80		SW-4 (seep)	(2)	47.5
4/9/84	Seep Location	(1)	100	11/18/92	SW-4 (seep)	(2)	50 U

7/12/84	Seep Location	(1)	110	12/30/92	SW-7	(2)	40
10/10/84	Seep Location	(1)	140		SW-7	(2)	55.0
4/12/85	Seep Location	(1)	10 U		SW-7	(2)	58.8
10/15/85	Seep Location	(1)	10 U		SW-7 Duplicate	(2)	40
1/26/86	Seep Location	(1)	10 U	6/17/93	SW-4 (seep)	(2)	50
4/24/86	Seep Location	(1)	10 U	9/14/93	SW-4 (seep)	(2)	50
11/4/86	Seep Location	(1)	10	9/22/94	T-H-SW-2	(3)	49
3/27/87	Seep Location	(1)	120		T-H-SW-3	(3)	10 U
6/10/87	Seep Location	(1)	130		T-H-SW-4	(3)	10 U
5/18/88	Seep Location	(1)	350	1/15/95	Seep Location	(1)	130
11/15/88	Seep Location	(1)	250	Chromium,Hexavalent			
2/3/89	Seep Location	(1)	220	9/22/94	T-H-SW-1 (seep)	(3)	10 U
5/15/89	Seep Location	(1)	250		T-H-SW-2	(3)	10 U
8/29/89	Seep Location	(1)	220		T-H-SW-3	(3)	10 U
5/2/90	Seep Location	(1)	240		T-H-SW-4	(3)	10 U
8/2/90	Seep Location	(1)	240	11/9/95	SW0-95 (seep)	(4)	100 U
6/7/91	Seep Location	(1)	190		SW15-95	(4)	100 U
5/18/92	SW-1	(2)	70.7		SW30-95	(4)	100 U
	SW-2	(2)	115		SW45-95	(4)	400
	SW-3	(2)	166		SW60-95	(4)	300

NOTES

U = Data qualifier: U = below quantitation limit (BQL)

(1) = SCDHEC permit-required quarterly sampling

(2) = RI surface water sampling events (RI Report, Aquaterra Env. Consultants, 1995)

(3) = SECOR 1994 post-RI surface water and sediment sampling

(4) = SECOR 1995 post-RI surface water and sediment sampling

repeated here. Total chromium sample results from the seep prior to the RI (1982 to May 1992) generally ranged from below a 0.010 mg/l detection limit, up to 0.350 mg/l. Sample locations for these samples are shown in Figure 9.

6.2.4 Sediment

Table 6 summarizes the sediment data collected from stations along the offsite tributary for the same phases of Site work as described immediately above. Sample locations match those presented in Figure 9 for surface water. In similar fashion to the surface water samples, concentrations of contaminants other than chromium in RI sediment samples were not significant for risk or remediation purposes and are not repeated here. In samples from the locations close to the seep (i.e. the 1994/1995 samples with the "SD" prefix), total chromium concentrations ranged from 2.63 mg/kg and 6.75 mg/kg deeper in the sediment (12 to 14, and 30 inches, respectively, below the sediment-water interface), to 1,643.75 mg/kg between 0 and 2 inches below the sediment-water interface. Total chromium at the downstream locations (SED 1 through SED 7) ranged from 10.8 mg/kg (SED 1, 5/92) to 523 mg/kg (SED 2, 5/92); however, excluding the 523 mg/kg value and one other detection at SED 7 (103 mg/kg, 101 mg/kg in the duplicate), the remaining eight downstream samples were all below 50 mg/kg. Maximum total chromium levels recorded from the seep (SED 4) and from approximately 50 feet uphill of it (SED 5) were 899 mg/kg and 630 mg/kg. Comparison of the sediment characteristics versus chromium content of the RI samples suggested that the distribution of chromium in stream sediment is closely associated with the presence of clays and organic matter, and is therefore likely to be extremely variable along the tributary streambed. Analysis for hexavalent chromium has been performed less frequently; detections occurred in seep bank samples (Seep 1, 3, 4) at 7, 10 and 1 mg/kg respectively, but none was detected at the far downstream locations SED 6 and SED 7. Seep area sediment ("SD" prefix) contained between 0.45 and 1.62 mg/kg hexavalent chromium.

6.3 Contaminant Migration

Site contaminants in soil (section 6.2.2), which are predominantly metals, are generally immobile once transferred to soil, and thus have remained near their source. Leachability work performed as part of the FS demonstrated, however, that low-level hexavalent chromium remaining in surface soils is likely leaching to groundwater at levels that would cause exceedance of the MCL. It is assumed that the same basic mechanism has been operating since 1964-1981 time period. As noted in section 6.1 above, surface

<IMG SRC 97019K>

TABLE 6
SEDIMENT SAMPLE RESULTS

Sample Date	Sample Location	Source	Depth (inches)	Concentration (mg/kg)
Chromium,Total				
5/18/92	Sed 1	[1]	Surface (a)	10.8
	Sed 2	[1]	Surface	523
	Sed 3	[1]	Surface	49.4
	Sed 4	[1]	Surface	162
	Sed 4	[1]	Surface	172
	Sed 5	[1]	Surface	32.8
9/29/92	Sed 1	[1]	Surface	17.1
	Sed 2	[1]	Surface	24.8
	Sed 3	[1]	Surface	38.2
	Sed 4	[1]	Surface	91.1
	Sed 5	[1]	Surface	899
12/30/92	Sed 6A	[1]	Surface	15
	Sed 7A	[1]	Surface	103
	Sed 7A Duplicate	[1]	Surface	101

Sample Date	Sample Location	Source	Depth (inches)	Concentration (mg/kg)
Chromium, Total				
11/8/95	SD30-95	[4]	0-2	1643.75
	SD30-95	[4]	12-14	263
	SD45-95	[4]	0-2	407.65
	SD45-95	[4]	10-12	18.41
	SD52.5-95	[4]	30	6.75
	SD60-95	[4]	12	94.68
	SD60-95	[4]	18	72.325
Chromium,Hexavalent				
11/8/95	Sed 6A	[1]	Surface (a)	0.02 U
	Sed 6B	[1]	Surface	0.02 U
	Sed 7A	[1]	Surface	0.02 U
	Sed 7A Duplicate	[1]	Surface	0.02 U
	Sed 7B	[1]	Surface	0.02 U
	Seep 3	[2]	12-18	10

	Sed 7B	[1]	Surface	13.4	
Seep 4	[2]	NA	1		
	Sed 6B	[1]	Surface	3.8	
Seep 1	[2]	0-6	7		
9/22/94	T-H-SD-1	[2]	Surface	630	
SDO-95	[4]	0-2	0.6		
	T-H-SD-2	[2]	Surface	35	
SDO-95	[4]	6-8	0.75		
	T-H-SD-3	[2]	Surface	2.2	
SD2.5-95	[4]	18	1.62		
	T-H-SD-4	[2]	Surface	1-U	
SD15-95	[4]	2-4	0.63		
	Seep 1	[3]	0-6	47	
SD15-95	[4]	12-14	0.66		
	Seep 2	[3]	0-12	255	11/8/95
SD30-95	[4]	0-2	0.51		
	Seep 3	[3]	12-18	116	
SD30-95	[4]	12-14	0.48		
	Seep 4	[3]	NA	8.0	
SD45-95	[4]	0-2	0.45		
11/8/95	SDO-95	[4]	0-2	552.3	
SD45-95	[4]	10-12	0.51		
	SDO-95	[4]	6-8	7.89	
SD52.5-95	[4]	24	0.78		
	SD15-95	[4]	2-4	170.95	
SD60-95	[4]	12	0.645		
	SD15-95	[4]	12-14	13.15	
SD60-95	[4]	18	0.69		

U = Data qualifier; u = below quantitation limit (BQL)
SURFACE = 0 to 6 inches below sed/water interface
[1] = RI sediment sampling events
[2] = SECOR 1994 sediment sampling
(3) = SECOR 1994 post-RI sediment sampling (bank of seep)
(4) = SECOR 1995 post-RI sediment sampling (seep area)

water in the offsite tributary has become contaminated through its main origin as groundwater discharge at the seep. Sediment likewise has become contaminated via groundwater discharge and consequent transfer of contaminants to the sediment. There is no evidence that direct surface water migration from the site (stream or overland flow) has occurred.

Groundwater contamination has migrated from its source in the former wastewater ponds area, to groundwater, surface water and sediment in the offsite area. This migration is believed to have resulted from dissolution and simple groundwater-flow transport. In the RI, probable average linear velocities (flowrates, V) were calculated based on a measured hydraulic gradient and a measured set of hydraulic conductivity (K) values, as follows:

Unit I upper sand	V = 7.6 ft/year
Unit I middle sand	V = 635 ft/year
Unit I lower sand	V = 197 ft/year

Comparison of these estimates with the groundwater contamination extent (Figure 6) indicates that offsite movement of Site contaminants has been retarded to a significant degree by various physical and chemical factors.

7.0 SUMMARY OF SITE RISKS

Actual or threatened releases of hazardous substances from this site could, if not addressed by the response action selected in this Record of Decision, present an imminent and substantial endangerment to public health and the environment. Potential risks to human health posed by the Site were quantified in a Baseline Risk Assessment (BRA) completed in late 1993, as part of the RI/FS. The BRA evaluated all risks caused by contamination detected in Site soils, groundwater, surface water and sediment.

After the RI, as part of the FS work during 1995, an Addendum to the Baseline Risk Assessment was prepared to revise the BRA conclusions regarding contaminated soils (only). The original BRA assumed a residential future use scenario. However, in accordance with recent guidance, EPA reevaluated likely future land usage and concluded that continued industrial use of the Site property is the most reasonable assumption. Use of an industrial land use scenario altered the assumptions concerning exposure frequency and duration, thus altering the calculated risk levels. The major effect of this revision ("Addendum to the BRA," Appendix B of the FS) was the determination that no unacceptable current or future risks are presented by Site soils, assuming continued industrial Site use.

Overall human health risks presented by this site may be qualitatively summarized as follows:

- Under the current land use, there are no unacceptable human health risks presented by the Site via any medium.

- Under the assumed future land use scenario, which is residential and commercial in the offsite area and continued industrial use of the Site, excess human health risks are presented via ingestion of contaminated groundwater.

The following sections summarize the major sections of the risk assessment process. Unless indicated otherwise, conclusions are based directly on the BRA (1993). Additionally, section 7.5 addresses potential ecological risks.

7.1 Chemicals of Concern (COCs)

COCs originate in the BRA from "chemicals of potential concern" (COPCs) , which comprise all of the chemicals occurring at the Site which could pose risks. All of the detected chemicals are compared to naturally-occurring background and essential nutrient concentrations, and screened for infrequent detection and common laboratory contaminants. A concentration- toxicity screening is then conducted, which removes those chemicals which do not have the potential to contribute significantly to risk. As detailed in the BRA, some 25 chemicals were considered chemicals of potential concern and were used in calculating health risks.

As a result of the risk calculation process, as described briefly in the following sections, a group of chemicals were identified, each of which contributes significant risk (noncarcinogenic risk (HI) 0.1 and carcinogenic risk > 10 -6) . These chemicals are referred to as the Site "chemicals of concern" (COCs) in the BRA and the Addendum.

From the original COC list (those appearing in Tables 8-6 through 8-17 of the BRA), all COCs in soils have been deleted based on the BRA Addendum as described above. No surface water COCs were identified in the BRA. During review of the draft FS, three groundwater COCs and one sediment COC were deleted by EPA: two VOCs, bromodichloromethane and chloroform ("Trihalomethanes") from groundwater, arsenic from groundwater, and arsenic from sediment. Neither of the two VOCs has exceeded 0.015 mg/l; the MCL for the Trihalomethanes group is 0.100 mg/l (total), which has never been approached in sample data. Arsenic concentrations in groundwater have ranged from 0.001 to 0.0031 mg/l, significantly below the MCL

(0.05 mg/1). The inclusion of arsenic as the lone sediment COC was based entirely on a single detection that has been judged spurious.

Finally, due to a revision in the reference dose for manganese, the corrected manganese groundwater remediation level would be above recorded maximum values in Site groundwater. These COC deletions are documented in the Site Administrative Record.

As a result of these changes, all of the nine remaining Site COCs occur in the groundwater medium:

chromium	lead	1,1-dichloroethylene
cadmium	nitrate	tetrachloroethylene
cyanide	vanadium	trichloroethylene

7.2 Exposure Assessment

Exposure assessment consists of identifying the specific population groups that could be affected by the Site, and evaluating the exposure pathways by which these people could be exposed to contaminants. Based on the original BRA and subsequent work, the potential exposure pathways can be summarized as follows;

- Currently, the Site is used for industrial purposes. There are no private water wells onsite or within the offsite areas which have Site- contaminated groundwater. Based on evaluation of the "Site worker" exposure scenario detailed in the BRA Addendum (soil ingestion, dermal contact) and the absence of any other current-use COCs, there are no viable exposure pathways onsite or offsite at present.

- Under a future land use scenario which includes residential development in the offsite area, unacceptable risk to residents could result from
  1. ingestion of contaminated groundwater, or
  2. inhalation of such groundwater during showering.

In order to quantify the exposure associated with each pathway, various standard assumptions are made for key variables in the exposure calculations (BRA and the Addendum). These variables include the contaminant level in the medium, usually referred to as the exposure point concentration; and the amount of the chemical taken into the body, or chronic daily intake, which must be calculated using a number of assumptions. To evaluate a Reasonable Maximum Exposure (RME) scenario, each of the variables was selected with the goal of producing the maximum exposure that could reasonably be expected to occur.

Table 7 lists and defines the assumptions used to calculate the daily intake of each COC. Table 8 presents the exposure point concentrations calculated for each of the COCs (as well as the toxicity values discussed in the following section). For each contaminant, the exposure point concentration represents the upper 95 percent confidence limit of the arithmetic mean of all sampling data (qualified as described in Section 7.1 above).

7.3 Toxicity Assessment

As part of the risk assessment, the toxic effects of Site contaminants were investigated and evaluated. Such effects may be carcinogenic, causing excess cancer risk, or noncarcinogenic in nature. In order to calculate risk, the variables described below are used.

The reference dose (RfD), used in estimating noncarcinogenic risk, is an estimate of the daily dose of a substance to which a person may be exposed without appreciable risk of health effects. It is expressed as mg/kg/day. RfDs are based on human epidemiological studies or animal studies, and have built-in uncertainty factors that prevent underestimation of potential adverse effects. To estimate carcinogenic risk, a slope factor is used to estimate the upper bound excess cancer risk posed by a lifetime of exposure to carcinogens. The slope factor is an estimate of the dose-response curve at very low doses, and is extrapolated from dose-response data at high doses.

Table 8 presents the toxicity values used to calculate Site risks. Carcinogenic contaminants are classified in the "WOE" column of the table according to EPA's weight-of-evidence system. This classification scheme is summarized below:

Group A: Known human carcinogen.

Group Bl: Probable human carcinogen, based on limited human epidemiological evidence.

Group B2: Probable human carcinogen, based on inadequate human epidemiological evidence but sufficient evidence of carcinogenicity in animals.

Group C: Possible human carcinogen, limited evidence of carcinogenicity in animals.

Group D: Not classifiable due to insufficient data.

Group E: Not a human carcinogen, based on adequate animal studies and/or human epidemiological evidence.

TABLE 7
SUMMARY OF EXPOSURE PARAMETERS

Pathway: Ingestion of groundwater, future land use scenario (residential)

Exposure Parameter: (see KEY below)	IR	EF	ED	BW	AT n	AT c
Population:						
Future adult residents	2.0	350	24	70	8,760	25,550
Future child residents	1.0	350	6	15	2,190	25,550

Exposure Intake Formula:

EPC x IR x EF x ED
BW x (AT n or AT c)

KEY

References for all variables are detailed in the Baseline Risk Assessment.

EPC= Exposure Point Concentration

IR = Ingestion rate of groundwater (liters/day).

EF = Exposure frequency (days or events/yr). 350: daily ingestion minus 2 wks annual vacation.

ED = Exposure duration (years). Adult- 24 years, child- 6 years.

BW = Body weight (kg). Standard values are 70 kg (adult average), 15 kg (children 1-6 yrs, 50th percentile.

AT n = Averaging Time (noncarcinogenic). 8,760 days for the adult (24 years x 365 days), 2,190 days for a child (6 years x 365 days).

AT n = Averaging Time (carcinogenic). 25,550 days for the adult (70 years x 365 days), also 25,550 days for a child (70 years x 365 days).

TABLE 8
COC EXPOSURE POINT CONCENTRATIONS
AND TOXICITY VALUES

Chemical of Concern	E.P. Conc. (mg/1) Medium = Groundwater	Reference Dose (mg/kq/day)			Cancer Slope Factor (mg/kg/day) -1			Cancer WOE
		Oral 1	Inhal-ation 2	Dermal 3	Oral 4	Inhal-ation 5	Dermal 6	
Chromium	2.74	5.00E-3	NA	1.00E-3	NA	4.20E+l	NA	A
Cadmium	0.001	5.00E-4	NA	1.00E-4	NA	6.30E+0	NA	B1
Cyanide	0.0242	2.20E-2	NA	4.40E-3	NA	NA	NA	
Lead	0.0111	NA	NA	NA	NA	NA	NA	B2
Manganese	0.1048	2.3E-2	1.43E-5	1.84E-2	NA			
Nitrate	10.83	1.6E+00	NA	3.20E-1	NA			
Vanadium	0.1096	7.00E-3	NA	1.40E-3	NA			
1,1-dichloroethylene	0.00525	9.00E-3	NA	7.20E-3	6.0E-1	1.75E-1	7.50E-1	C
Tetrachloroethylene	0.00709	NA	NA	NA	5.2E-2	2.0E-3	6.5E-2	B2
Trichloroethylene	0.03359	6.00E-3	NA	4.80E-3	1.1E-2	6.00E-3	1.38E-2	

NOTES

1. Oral reference doses are taken from IRIS except as follows; vanadium dose is from HEAST, trichloroethylene dose was obtained from NCEA Superfund Technical Support Center.
2. Manganese inhalation reference dose was taken from IRIS.
3. All dermal reference doses assume a 20% absorption efficiency of the oral reference dose, except as follows: 1,1-dichloroethylene and trichloroethylene reference doses assume an 80% efficiency of the oral reference dose.
4. Oral slope factors are from IRIS, except for tetrachloroethylene and trichloroethylene, which were obtained from the NCEA Superfund Technical Support Center.
5. Inhalation slope factors are from IRIS, except for tetrachloroethylene and trichloroethylene, which was obtained from the NCEA Superfund Technical Support Center.
6. Dermal slope factors for the three COCs which have them assume an 80% absorption efficiency of the oral slope factor.
7. WOE = weight of evidence used to classify carcinogenic substances (see text).

7.4 Human Health Risk Characterization

The final step of the Baseline Risk Assessment is the generation of numerical estimates of risk. In the BRA and the Addendum, this was accomplished by integrating the exposure and toxicity information described above. Table 9 summarizes the total hazard quotient (noncarcinogenic risk) and total cancer risk, respectively, associated with the Site.

To estimate noncarcinogenic risk, hazard quotients (HQs) are calculated for each contaminant in each exposure pathway. The HQ is the ratio of the daily intake divided by the RfD. An HQ value equal or close to unity (1) indicates the potential for adverse effects. For each pathway, the individual contaminant Hqs are added together to give a total hazard index, or HI. Under a reasonable maximum exposure scenario, a person could be exposed to more than one pathway (for example, if groundwater were used for potable water, both ingestion of groundwater COCs, and inhalation of COCs while showering). Therefore, the total HI for each population is a summation of the constituent exposure pathways. Carcinogenic risk estimates are generated in similar fashion for exposure pathways and populations.

Based on the National Oil and Hazardous Substances Contingency Plan, or NCP, EPA uses a benchmark of Hazard Index (HI) = 1.0 to identify unacceptable noncarcinogenic risks (HI > 1) which require remedial action. For Sites where hazardous substances cause excess risk of cancer, a risk level greater than one in ten thousand, or 1 X 10 -4 (i.e. one excess cancer death in 10,000 persons) is unacceptable and requires EPA to take remedial action, while for situations with risk levels between 1 X 10 -6 (one in one million) and 1 X 10 -4 EPA may require action. An excess risk of less than 1 x 10 -6 is considered sufficiently protective of human health and the environment.

There are no human health risks under present use conditions. Under the future use (residential) scenario, excess carcinogenic risk to future water well users in the offsite area is estimated to be 4 x 10 -5 for adult resident and 2.5 x 10 -5 for child resident. The risk is due entirely to potential ingestion of, and exposure via showering to, shallow groundwater. Noncarcinogenic risk is presented under a future use scenario and is estimated at HI = 45.8 for the adult resident and 108.6 for the child resident. As above, excess risk is due entirely to potential ingestion of, and exposure via showering to, shallow groundwater.

TABLE 9
SUMMARY OF TOTAL SITE RISKS

Chemical of Concern	E.P. Conc. (mg/1) medium = Groundwater	Noncarcinogenic Risk Oral	Noncarcinogenic Risk Inhalation	Hazard Index	Cancer Risk Oral	Cancer Risk Inhalation	Cancer Risk
Future Use Scenario: Adult Resident Groundwater Exposures							

Chromium	2.74	14.8	NA	14.8	NA	NA	-
Cadmium	0.001	NA	NA	-	NA	NA	-
Cyanide	0.0242	29.7	NA	29.7	NA	NA	-
Lead	0.0111	NA	NA	-	NA	NA	-
Nitrate	10.83	0.183	NA	0.183	NA	NA	-
Vanadium	0.1096	0.423	NA	0.423	NA	NA	-
1,1-dichloroethylene	0.00525	NA	NA	-	2.96E-5	3.6E-6	3.32E-5
Tetrachloroethylene	0.00709	NA	NA	-	3.47E-6	NA	3.47E-6
Trichloroethylene	0.03359	0.151	NA	0.151	3.47E-6	NA	3.47E-6

TOTAL SITE RISKS (2)

Adult Resident: Future Use Scenario Noncarciuogenic Risk 45.25 Carcinogenic Risk 4.0E-5

NOTES

1. For 1.1-dichloroethylene, which contributes risk via inhalation during showering, the air concentration utilized was 0.13436 mg/m 3.
2. The totals for both carcinogenic and noncarcinogenic risks differ from those presented in Table 8-1 of the Baseline Risk Assessment (Dynamac 1993) due to the deletion of arsenic, chloroform and bromodichloromethane as COCs. Refer to pages 45-46 of this ROD.

TABLE 9 (continued)
SUMMARY OF TOTAL SITE RISK

Chemical of Concern	E.P. Conc.[1] (mg/1) medium = Groundwater	Noncarcinogenic Risk Oral	Noncarcinogenic Risk Inhalation	Noncarcinogenic Risk Dermal	Hazard Index	Cancer Risk Oral	Cancer Risk Inhalation	Cancer Risk Dermal	Cancer Risk(1)
Future Use Scenario: Child Resident Groundwater Exposures									
Chromium	2.74	35.1	NA	NA	35.1	NA	NA	NA	-
Cadmium	0.001	0.128	NA	NA	-	NA	NA	NA	-
Cyanide	0.0242	70.4	NA	NA	70.4	NA	NA	NA	-
Lead	0.0111	NA	NA	NA	-	NA	NA	NA	-
Nitrate	10.83	0.433	NA	NA	0.433	NA	NA	NA	-
Vanadium	0.1096	1.00	NA	NA	1.00	NA	NA	NA	-
1,1-dichloroethylene	0.00525	NA	NA	NA	-	1.70E-5	4.04E-6	NA	2.10E-5
Tetrachloroethylene	0.00709	NA	NA	NA	-	1.99E-6	NA	NA	1.99E-6
Trichloroethylene	0.03359	0.358	NA	NA	0.358	2.00E-6	NA	NA	2.00E-6

TOTAL SITE RISKS (2)

Child Resident	Future Use Scenario	Noncarcinogenic Risk	107.29	Carcinogenic Risk 2.50E-5

NOTES

1. For 1,1-dichloroethylene, which contributes risk via inhalation during showering, the air concentration utilized was 0.13436 mg/m^3.
2. The totals for both carcinogenic and noncarcinogenic risks differ from those presented in

Table 8-1 of the Baseline Risk Assessment (Dynamac 1993) due to the deletion of arsenic, chloroform and bromodichloromethane as COCs. Refer to pages 45-46 of this ROD.

It should be noted that there is some degree of uncertainty associated with the calculated numerical estimates of human health risks generated in the Baseline Risk Assessment and the Addendum. This is due to the considerable number of assumptions required to calculate risks, and in the specific selections made for each variable from a range of possibilities.

7.5 Environmental (Ecological) Risks

The 1993 BRA recommended further investigation of Site ecological communities and the potential for toxicity to stream biota. Toward this end, field work for an Ecological Assessment (EA) was carried out in late 1993 and a final EA Report completed in May 1994. The EA included both a field assessment (Rapid Bioassessment Protocol II) and laboratory toxicity studies.

Concerning surface water, the EA concluded that there was evidence of observable toxicity to test organisms in water containing 0.049 mg/l total chromium. Based on this, a "no observable effects" level (NOEL) was estimated at 0.024 mg/l. Concerning sediment, toxicity was not demonstrated or resolved due to problems related to natural background effects.

Total chromium levels in seep sediment ranged up to 630 mg/kg and 899 mg/kg, 8 to 11 times the relevant EPA Region IV Sediment Screening Value of 81 mg/kg, which is based on National Atmospheric and Oceanic Administration (NOAA) sediment screening criteria. The NOAA "Effects Range Low" (ER-L) value, 81 mg/kg, represents the lower end (lowest 10%) cutoff value within a range of total chromium levels shown to have caused toxicity in a large group of studies nationwide, with each number from one study. Based on (1) the documented total chromium levels in seep sediment, (2) the NOAA sediment criteria, (3) the exacerbating effect of the very low mineral content of tributary water, and (4) consultation with the US Fish and Wildlife Service regarding their experience at other chromium sites, EPA believes that offsite sediment is capable of causing ecological harm in the offsite area if left unaddressed.

No state- or federally- designated endangered or threatened species are known to exist on the facility property. This is also true for the offsite area, although active nesting sites of the endangered Red-cockaded Woodpecker are located approximately one to two miles south of the Site at Fort Jackson.

8.0 DESCRIPTION OF REMEDIAL ALTERNATIVES

Remedial alternatives for addressing Site contamination were developed in the FS. As an initial step, the general objectives to be attained by the selected remedy (Remedial Action Objectives, RAOs) were determined and are presented in section 8.1 below. Working from these RAOs, which are general in nature, the FS considered health-based criteria from the risk assessment work, as well as all of the applicable or relevant and appropriate requirements (ARARs), in order to develop appropriate remediation levels (RLs) for Site contaminants. Site RLs are presented in section 8.2 below.

Although RAOs were developed for soil, groundwater and surface water, separate remedial alternatives such as those described in sections 8.3 and 8.4 were not developed to specifically address surface water and sediment. However, surface water and sediment will be addressed as part of any of the groundwater alternatives:

Surface water: Since the source of tributary water is predominantly groundwater, the applicable surface water RL will be accomplished through remediation of groundwater.
Sediment (see section 7.5): EPA has determined that a small-scale removal of sediment in the seep area would remove any actual or potential ecological threats from contaminated sediment, and would constitute a sufficient and cost-effective action in comparison to further ecological or toxicity studies. Thus, while no sediment remediation level has been established, contaminated sediment will be addressed by performance of this excavation and removal action as described in the FS. The area to be addressed is a small elongate basin just downstream of the actual seep (surrounding the "SD" sample locations in Figure 9). The action will remove the uppermost layer of highly-impacted chromium -bearing sediment and is expected to include approximately 30 - 85 cubic yards of material. It will be performed after the effectiveness of the groundwater remedy is demonstrated, so that newly-exposed sediment is not re-

contaminated following the action.

8.1 Remedial Action objectives (RAOs)

The following Site-specific RAos were established in the FS:

Soil:

- Prevent the leaching of contamination into groundwater, which can contribute to human health risk via groundwater;

Groundwater:

- Prevent exposure to chemicals of concern in groundwater which pose an unacceptable human health risk

- Reduce concentrations of chemicals of concern, thereby restoring potential use of the aquifer as a potable water source; and

- Prevent or reduce the continued discharge of contaminated groundwater to surface water, such that surface water quality standards are not exceeded.

Surface Water:

- Reduce contamination to levels which a) cannot pose ecological risk to tributary flora and fauna, and b) are incapable of re-contaminating tributary sediment.

Sediment:

- Prevent exposure of the tributary ecosystem to chemicals of concern, and/or reduce the concentrations of chemicals of concern such that no unacceptable ecological risks are presented.

8.2 Remediation Levels

In order to establish site-specific remediation levels (RLs), the following were considered in the FS:

1. Health-based criteria (suggested RLs) from the BRA and the BRA

Addendum;

2. ARARs which pertain to the Site location, specific Site contaminants, or specific types of remedial actions; and
3. EPA guidance concerning calculation of permissible site specific surface water concentrations protective of ambient surface water quality.

RLs for the site are presented in Table 10. The RL for surface soils was determined (FS Appendix D) based on leachability testing of field samples, which identified a hexavalent chromium level at or below which leaching to groundwater at a level capable of impacting groundwater above the MCL does not occur. This RL is based only on the requirement to protect groundwater, as there is no unacceptable current or future risk presented by Site soils. All of the groundwater RLs are based on their respective MCLs

TABLE 10
SITE REMEDIATION LEVELS

Medium 1	Chemical	Remediation Level
Surface Soil (2)	Chromium +6 (hexavalent)	16 mg/kg
Surface Water	Chromium (3)	0.040 mg/1
Groundwater (4)	Chromium (total)	0.100 mg/1
	Cadmium	0.005 mg/1
	Cyanide	0.200 mg/1
	Lead	0.015 mg/1
	Nitrate	10.0 mg/1
	Vanadium (6)	0.110 mg/1
	1,1-dichloroethylene	0.007 mg/1
	Trichloroethylene	0.005 mg/1
	Tetrachloroethylene	0.005 mg/1

NOTES

(1) Although not listed here, sediment is affected by site-related contamination and is addressed by the selected remedy described in this Record of Decision. See section 8.0.
(2) Remediation level (RL) is for the protection of groundwater from leaching. This RL was determined from leaching tests using Site soils and a target groundwater level of 0.100 mg/1, the State and Federal maximum Contaminant Level (MCL) for chromium.
(3) Measured as hexavalent or total chromium. The RL in based on the State and Federal chronic ambient water quality criterion (AWQC) for chromium. It is intended for the protection of the ecosystem in and along the offaite tributary; there is no human health threat associated with chromium in surface water. The RL is based upon the AWQC, which South Carolina considers to be a relevant and appropriate criterion for protecting surface water quality in the offsite tributary and surface waters statewide.
(4) All groundwater RLs are State and Federal Maximum Contaminant Levels (MCLs) under the Safe Drinking water Act (1974), except as indicated in footnotes (5) and (6) below:
(5) EPA Action Level.
(6) Baseline Risk Assessment, Townsend Saw Chain Site (Dynamac 1993).

ATTACHMENT A

Proposed Plan for Townsend Saw Chain Superfund Site

except for vanadium, which is based on the BRA (BRA chapter 8). As noted previously, there are no separate RLS for sediment, although sediment will be addressed as part of the groundwater remedial alternative once selected (see 8.0 above). Finally, a chromium surface water RL, based on the Federal and State ambient water quality criterion (AWQC), was developed by SCDHEC in December 1996. The AWQC is considered a relevant and appropriate ARAR by the State of South Carolina for surface water quality.

8.3 Source Control (Soil) Remedial Alternatives

All costs in this section and in section 8.4 below are estimates and should be considered approximate (+/- 30%). They are intended primarily for comparison among alternatives. In accordance with EPA guidance, a discount factor of 7% was used in calculating net present worth cost. Certain of the soil and groundwater alternatives include preparing CERCLA-required Five-Year Reviews, which are remedy status reports necessary for a selected remedial alternative in which hazardous substances will remain on a site longer than 5 years.

8.3.1 Alternative S1: No Action

Under CERCLA, consideration of cleanup alternatives must always include a "no action" option, to serve as a baseline for comparison to the other alternatives. In theory, under this alternative, no activities would be undertaken nor any funds expended to address Site soil contamination. The practical effect of taking no action would be to allow continued leaching of chromium to groundwater to occur; surface soils in the former wasteponds area are believed to be a continuing source of chromium contamination to the underlying groundwater. Such leaching may well be lengthening the current groundwater cleanup process (extraction and treatment) by transporting chromium back into the groundwater. Under the likely future land use scenario of continued industrial use of the Site property, surface soil poses no human health risks to Site workers or tresspassers.

The only cost associated with this alternative is for Five-Year Reviews, assuming that some of the contaminated surface soils remaining onsite will be shown (by test) to constitute hazardous waste. ("Hazardous wastes" are defined by the Resource Conservation and Recovery Act (RCRA), which governs handling and disposal of hazardous wastes and regulates facilities which generate and/or store such materials.) At a cost of $15,000 each and assuming six reviews over a 30-year period, the total cost is approximately $34,000.

8.3.2 Alternative S2: RCRA Cap

Under this alternative, chromium-bearing surface soils would be left in place, the area graded, and then capped with an impermeable material. The intent of this action is to inhibit the infiltration of surface water into and through the impacted area. Such a cap would be constructed in accordance with the requirements of RCRA. A cap would protect the impacted soils from surface water infiltration through the use of a low hydraulic conductivity layer (geomembrane or soil), a drainage layer and a stabilizing soil/vegetation layer over the affected areas.

Construction of a RCRA-type soil and geomembrane cap would likely require up to six months, and maintenance of the covered area would be expected to occur over the lifetime of the cap (typically 30 years). Typical maintenance would include periodic inspections to locate and repair any damage to the cap which could be caused by settling or erosion. The location, toxicity and volume of affected soils would remain the same after capping activities. A properly engineered cap would be expected to reduce transport and dispersion of contaminants in the affected soils, including the leaching of chromium to groundwater.

In general, capping is technically feasible for containing the affected area of soil. Short-term exposures of construction workers to chromium-bearing soils are manageable, primarily through the use of water to maintain dust control during excavation activities. Equipment for installing a cap would likely be readily available; similarly, the needed approvals and permits can likely be readily obtained.

The costs for implementing Alternative S2 are $506,000 in capital costs, and $40,000 in annual operations and maintenance (O&M) costs (includes Five Year Reviews), for a total net present worth cost of $546,000.

8.3.3 Alternative S3: Solidification/Stabilization

Alternative S3 involves the treatment of impacted soil by stabilization or solidification techniques. These are additives or processes which physically or chemically immobilize contaminants in soils. Stabilization agents such as Portland cement and sodium silicate are commonly utilized for the treatment of heavy metal impacted soils. This system maximizes the containment of inorganic chemicals of concern within the treatment area, by thoroughly immobilizing them within a hardened resistant mass, or "monolith."

Implementation would involve adding aluminosilicate materials and cement with water to the soils. The soils and binders would be thoroughly mixed with machines typically used for concrete mixing, or they could be mixed in place with backhoe equipment. After mixing is complete, the soils would be backfilled into the original excavation and allowed to cure and harden. The hardened soil matrix would then be covered with one foot of native soil, graded to provide adequate drainage, and a vegetative stand would then be established. Beforehand, a pilot treatability study might be required to confirm that this alternative can meet the remediation levels.

Stabilization/solidification would likely be completed in less than one year. Performance of the process in resisting leaching or natural degradation will depend on proper operation of equipment, particularly during mixing, and on accurate characterization of physical soil conditions.

Stabilization/solidification may require excavation of affected soils before treatment, although the treatment itself can in theory be performed insitu. Dust control measures would be needed if excavation is required. Short-term community and worker exposures could occur from particulate emissions from the pretreatment screening, crushing and mixing processes. If stabilization/solidification is conducted insitu, however, short term exposure of nearby community and onsite workers to the potential contaminants would not be expected. After treatment, hexavalent chromium in the soil will have undergone a significant reduction in its mobility and hence its toxicity. Operations would not be expected to adversely affect the environment in the Site vicinity.

Stabilization/solidification is expected to be technically and administratively feasible, based on the effectiveness of this technology at similar sites. Equipment for implementing stabilization/solidification would likely be readily available.

The costs for implementing this alternative include $722,000 in capital costs. Because treated wastes would remain onsite, Five Year Reviews would be required, although typical Five Year Review requirements and costs would essentially be covered within the currently-ongoing groundwater monitoring. With the inclusion of $88,000 in annual, repeating operations and O&M costs, the total net present worth cost is $810,000.

8.3.4 Alternative S4: Insitu Chemical Treatment

Insitu chemical treatment, and specifically, insitu chromium reduction, is a new, "innovative" technology in which a liquid solution containing a reducing agent is placed on, and percolated

into, chromium-bearing soils. Upon contact with the reducing agent, hexavalent chromium in the soils are reduced to an insoluble, non-toxic, more stable chemical state. The treatment may be accomplished insitu, that is, with no excavation required; reagent may be simply percolated into the soil. This technology is particularly applicable to sites with shallow soil impacts (< 2 feet deep) such as the Townsend Saw Chain Site. Insitu chromium reduction is classified by EPA as an "emerging" technology, which means that it has been employed at a limited number of sites and therefore, extensive operational data are not available at present.

To implement insitu chemical treatment, first, surficial soils and sludges (up to 6 inches) within the former wastewater ponds area would be removed and disposed of offsite. This will remove the most highly affected soils and break up the crusty top layer, improving contact of the treatment solution with the chromium-impacted material. Introduction of the solution may be accomplished by any number of means, including injection or use of surface application equipment, such as that in use at the onsite sprayfields. The treatment solution percolates through impacted soils and reduces the hexavalent chromium. Soil sampling would be undertaken to verify the effectiveness and permanence of the reduction/immobilization effects. Targeted or repeated applications may be required to achieve the remediation levels.

Pilot-scale treatability testing was conducted at the Site during late April - early May 1995, as reported in the treatability study report entitled "Demonstration Study: In-situ Chromium Reduction in Soil and Groundwater, Homelite - Textron." The EPA National Risk Management Research Laboratory in Cincinnati, Ohio assisted in EPA's review of this work. The Demonstration Study was not intended to determine all of the delivery methodologies, operating parameters, and testing programs needed for full-scale implementation, but rather to demonstrate the basic chemical effect in onsite field trials. Reduction of hexavalent chromium concentrations was demonstrated in both soil and groundwater.

Insitu chemical treatment activities would be expected to occur over a period of approximately two years. Reduction of hexavalent chromium to concentrations below levels of concern is likely to occur rapidly. Additional treatability work will likely be needed to determine design parameters before full-scale remediation. If needed, installation of insitu chemical injection equipment should be implementable at the Site without major technical or administrative difficulties. Dust control measures and personal protective equipment would be required during the first stage of remedial activities, excavation of the top 6 inches of soil, to prevent short-term exposures of the community and Site workers to contaminants. No significant difficulties in obtaining qualified personnel, appropriate materials, or regulatory permits are anticipated for conducting chemical treatment activities.

Alternative S4 would involve $769,000 in capital cost outlays. Assuming treatment is successful, Five Year Reviews would not be necessary, although the requirements and costs would be covered in any case within the currently-ongoing groundwater monitoring. Approximately $88,000 in annual O&M costs are anticipated, for a total net present worth cost of $857,000.

8.3.5 Alternative S5: Excavation and Offsite Disposal

This alternative would involve excavating the impacted soils at the Site, and disposing of the soils offsite at a RCRA - permitted hazardous waste landfill. It may be possible to dispose of the soil at a RCRA solid waste landfill, which would be less expensive than disposal in a hazardous waste landfill. The final destination of the impacted soil would be decided during remedial design, depending on the results of soil sampling. For cost estimating purposes, it will be assumed that the soil will be disposed of at a hazardous waste landfill.

The areal extent of the soils having hexavalent chromium concentrations greater than the remediation level of 16 mg/kg is 35,000 square feet, with an average depth of two feet. This calculates to approximately 2,600 cubic yards of soils which have been affected by hexavalent chromium, located primarily in the former wastewater ponds. No particular technical difficulties are anticipated with excavation, although a water source would be required for dust control during the handling of soils. Air monitoring of particulates may be required during excavation activities, due to the elevated concentrations of hexavalent chromium in certain areas of surface soil. Permits are expected to be required by local, state and federal agencies for the transportation of affected soil from the Site to a hazardous waste treatment/disposal facility.

After excavation, clean native fill material would be placed in the excavation, and compacted as needed. The entire excavation location would then be graded to provide proper drainage and a natural vegetation stand would be established to reduce erosion. Offsite disposal activities would be completed within one to two months. It is anticipated that no O&M costs would be incurred after carrying out this alternative. Remedial objectives would be met by this alternative.

Excavation and offsite disposal costs will include $1,365,000 in capital costs, and since the affected soils would no longer be onsite, no Five Year Reviews and no annual O&M costs, for a total net present worth cost of $1,365,000.

8.4 Groundwater Remedial Alternatives

Each groundwater alternative described in this section, other than the no action alternative, includes the following components, as described in the Proposed Plan. The no action alternative does not include items 3 and 4 below.

1. Continued operation of the Interim Action pump-and-treat system (IAPTS);

2. Continued quarterly monitoring of selected wells on- and off site, in order to properly monitor the effectiveness of the selected groundwater alternative (as is presently done for the IAPTS);

3. Regular (periodic) sampling of off site tributary surface water at one midpoint station and one downstream station (both upstream of Spears Creek), in addition to the ongoing quarterly sampling of the seep/spring area; and finally,

4. Performing a small-scale sediment removal in the offsite seep area (estimated 30-85 cubic yards). This action will be conducted after the effectiveness of the IAPTS in capturing the affected groundwater has been demonstrated, in order to prevent re-contamination of the sediment by chromium-bearing surface water (see 8.0 above)

8.4.1 Alternative GW1: No Action

As with the soil no action alternative, under this alternative, no activities would be undertaken nor any funds expended to address Site groundwater contamination. However, the IAPTS, constructed in 1995, is currently operating and is expected to play a role in the Site remedy. Therefore, for comparison purposes, this alternative will consist of continued operation of the IAPTS only.

The costs for constructing, operating and maintaining the IAPTS, which includes the associated analytical and reporting requirements, are $2,058,000 in capital costs and $1,992,000 in annual O&M costs (30 years). Because of the ongoing groundwater monitoring and reporting, Five Year Reviews would be covered in routine ongoing reporting, and costs would be minimal to none. The total net present worth cost is thus $4,050,000.

8.4.2 Alternative GW2: Groundwater Use Restrictions and Monitoring

Under this alternative, institutional controls would be implemented to restrict the use of contaminated groundwater. State-imposed deed restrictions would be used to prevent certain future uses of the aquifer, such as for potable and industrial water supplies, irrigation, and washing. Permit restrictions would require the State of South Carolina to restrict all well drilling permits issued for new wells on properties that may draw water from the impacted groundwater plume. These restrictions may be written into the property deeds to inform future property owners about the possibility of impacted groundwater beneath their property.

Ongoing groundwater assessments would be performed to address impacts to groundwater quality downgradient of the Site and future land use considerations. This would require periodic groundwater sampling to monitor the movement of the groundwater plume as well as water quality within it.

Although this alternative would prevent human exposure to contaminants, it could require a very long treatment period to meet the Site objectives of 1) reducing contaminant concentrations in surface water to ecologically-sound conditions, or 2) restoring groundwater to its beneficial use as a potable water source. Natural reductions of contaminant levels in groundwater may occur, but the time period involved would likely be very long.

Costs for implementing use restrictions and monitoring only are $2,086,000 in capital costs and $1,992,000 in long-term O&M costs. Five Year Reviews are not included for the same reasons described above under Alternative GW1. Total net present worth cost is $4,078,000.

8.4.3 Alternative GW3A: Groundwater Extraction, Treatment, Sprayfield Discharge

Alternative GW3A consists of installing additional extraction wells throughout the Site, to increase the quantity of impacted groundwater removed, and treatment of this larger quantity of groundwater. This would essentially represent an expansion of the existing IAPTS.

Installation of an extraction, treatment and discharge system is expected to require several months. Operation and maintenance of the system is expected to occur over the lifetime of the system (for cost-estimating purposes, thirty years). For treatment, a

chemical reduction process would be used as is currently being used for the IAPTS. The treated water would be discharged to the currently-permitted sprayfield. Appropriate equipment is available for the activities needed under this alternative. Installation of the required process equipment would be expected to be completed at the Site without major technical or administrative difficulties, based on recent experience with IAPTS construction and installation. No significant difficulties in obtaining permits or approvals are anticipated for conducting expanded pump-and-treat activities.

Groundwater extraction and treatment is a reliable and proven technology. An advantage of this system is that it would be an expansion of the existing IAPTS, and ongoing operations and maintenance and groundwater monitoring programs could merely be expanded. When operating properly, a pump-and-treat system (whether the IAPTS or an expanded system as envisioned here) can meet the remedial levels for both hexavalent chromium and the other groundwater COCs. However, pump-and-treat remediation is affected by a variety of subsurface geochemical processes which often lengthen the time necessary to bring contaminant concentrations down to standards. EPA has documented that, over time, contaminant concentrations level off above remediation targets (usually the MCL), requiring inordinate amounts of time to achieve any further minor reductions.

This alternative assumes that five new pumping wells would be needed. Pumping of these wells would capture dissolved contaminants and create a hydraulic barrier to control contaminant migration. Groundwater modelling would be conducted during remedial design to determine the actual locations and pumping rates of the wells. An extraction rate of 30 gpm was assumed for cost estimating purposes, based on preliminary modelling conducted for the IAPTS. A thirty-year operation duration was assumed due to the relatively slow attainment of the MCLs as described above.

Alternative GW3A will involve $4,028,000 in capital costs and $2,655,000 in annual O&M costs. Five Year Reviews are not included for the same reasons described above under Alternative GW1. The total net present worth cost is thus $6,683,000.

8.4.4 Alternative GW3B: Groundwater Extraction, Treatment, POTW Discharge

Alternative GW3B is identical to Alternative GW3A, except that the treated groundwater would be discharged to a local publicly-owned treatment works (POTW), rather than being discharged to the onsite sprayfield. Depending on the Industrial Pretreatment standards

required by the POTW, it is possible that some or all of the treatment steps of the current treatment process may no longer be necessary. Additional costs would be incurred, in the form of fees, to discharge to a POTW. The treatment system's effluent would be monitored to assure compliance with the Industrial Pretreatment standards and any other requirements established by SCDHEC.

Costs for this alternative include a capital cost of $4,051,000 plus $2,762,000 O&M costs, for a total cost of $6,813,000.

8.4.5 Alternative GW4: Insitu Chemical Treatment

As described earlier under Alternative S4, Insitu Chemical Treatment is a new, innovative technology which uses liquid solutions containing a reducing agent. To remediate groundwater, the solutions are delivered into the saturated zone (into the aquifer) to allow and foster contact between contaminated groundwater and the reductant solution. Upon contact, the hexavalent chromium in the affected groundwater is reduced, and precipitates, forming an inert, insoluble, non-toxic mineral containing chromium in its more stable (trivalent) chemical state.

Insitu chemical treatment activities are expected to occur over a period of approximately one to two years. Reduction of hexavalent chromium to a concentration below the remediation level is expected to occur rapidly; however, a phased approach to remediation would likely be undertaken. In conjunction with the existing IAPTS, this alternative would provide a contained "treatment area" for groundwater, within which evaluation of the reduction/ immobilization effects can be evaluated. Insitu chemical treatment performance would depend in large measure on maintaining peak operating conditions and careful maintenance of the delivery systems used to place the reductant solutions into contact with groundwater. Specially-targeted or repeated applications may be required to achieve the chromium remediation level. Even with a phased approach, insitu chemical treatment is expected to be conducted over a short time (one to two years) , with minimal maintenance of treatment equipment required. Regular monitoring of the affected groundwater would be required throughout the remediation process.

Chemical treatment is a commonly-used technology ex-situ (i.e. in treatment vessels) for treating groundwater affected by heavy metals, and is the technology currently in use at the Site. As an insitu treatment, however, there is very little operational record from environmental sites upon which to conclude that the treatment will, without uncertainty, based on similar sites, perform exactly

as intended. However, this is also true for a number of other innovative technologies in use at EPA sites.

There are no obvious technical problems which would preclude use of the treatment. The reducing solutions used will likely contain small amounts of sulfate; however, Site groundwater data show that it already contains sulfate, suggesting that the addition of more sulfate via the injected solutions should not significantly affect the natural groundwater composition. The quantities of chemicals likely to be used in the solutions are minimal and unlikely to pose problems in gaining the needed permits for injection via wells. Appropriate equipment is expected to be available as needed, and installation of it is unlikely to pose any difficulties. Equipment options may include, alone or in combination, use of the current sprayfield equipment, multiple well points, or other simple technologies capable of delivering the solutions to the affected groundwater.

Pilot-scale treatability testing was conducted at the Site during late April - early May 1995 ("Demonstration Study: In-situ Chromium Reduction in Soil and Groundwater, Homelite - Textron"). As noted under Alternative S4, the Demonstration Study showed that the basic chemical effect, reduction of hexavalent chromium concentrations in groundwater, was demonstrated. Additional treatability work would be needed to determine design parameters before full-scale remediation.

During the treatment period, while the IAPTS is operational, remediation levels for all of the chemicals of concern would be pursued. However, under this Alternative, if hexavalent chromium levels throughout the plume are successfully and substantially reduced to levels below the groundwater remediation level (0.1 mg/1), the need for continued groundwater extraction and/or groundwater treatment to address the other groundwater CoCs would need to be considered separately, depending on the concentrations still present in the aquifer. This could require EPA to modify the Site remedy in order to 1) consider the need for, and effectiveness of, continued pumping, and 2) consider other options, such as reduced or targeted pumping, dispersion modelling and/or modelling of other natural degradation processes, and/or use of any new or innovative technologies as may become available.

The cost estimates assume that the IAPTS operates for a total of five years, and that successful treatment eliminates the need for Five Year Reviews. Capital costs for Insitu Chemical Treatment total $2,624,000, which includes approximately $1.4 million for construction of the IAPTS; and O&M costs of $658,000, for a grand total cost of $3,282,000.

9.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

As set forth in the NCP, 40 CFR 300.430(e)(9), EPA uses nine criteria to evaluate the remedial alternatives which could be employed for a given Site. These criteria are described below. To be selected by EPA, an alternative must meet the first two "threshold" criteria, overall protection of human health and the environment, and compliance with ARARs. Criteria 3 through 7 are used to identify differences and advantages among those alternatives which meet the threshold criteria. Finally, the preferred alternative is then further evaluated against the final two criteria, State acceptance and community acceptance.

An evaluation of the proposed remedial alternatives in relation to each of the nine criteria is presented below. A description of each criterion is followed by the site-specific analysis, indicated by the " • " symbol. For ease of reference in reviewing the alternatives, Table 11 below presents a summary of the remedial alternatives and associated costs. As noted at section 8.3, costs are estimates and are intended for comparison purposes.

TABLE 11
REMEDIAL ALTERNATIVES

Medium	Alt.	Title	Cost
Soil	S1	No Action	$34,000
	S2	RCRA Cap	$546,000
	S3	Solidification/ Stabilization	$810,000
	S4	Insitu Chemical Treatment	$857,000
	S5	Excavation and Offsite Disposal	$1,365,000
Groundwater	GW1	No Action	$4,050,000
	GW2	Groundwater Use Restrictions and Monitoring	$4,078,000
	GW3A	Groundwater Extraction, Treatment, and Sprayfield Discharge	$6,683,000
	GW3B	Groundwater Extraction, Treatment, and Sprayfield Discharge	$6,813,000
	GW4	Insitu Chemical Treatment	$3,282,000

1. overall Protection of Human Health and the Environment addresses the degree to which an alternative meets the requirement that it be protective of human health and the environment. This includes an assessment of how public health and environmental risks are properly eliminated, reduced or controlled through treatment, engineering controls, or controls placed on the property to restrict access and (future) development.

• The no action alternatives for both soil and groundwater would not be as protective of human health and the environment as would the other choices available for selection. Although the groundwater no action alternative would include continued operation of the Interim Action Pump-and-Treat System, no action would be undertaken to address offsite tributary sediment or monitor its downstream water quality (currently only the seep is sampled). Also, under the soil no action, leaching of chromium to groundwater that is probably occurring now would be allowed to continue, thus continuing to impact groundwater and working against the current groundwater pump-and-treat effort.

- Most of the other alternatives would likely be protective of human health and the environment. However, excavation and offsite disposal of soil (S5) may simply transfer the disposal problem to the community where the landfill is located, and thus may not be protective of human health due to the possibility of release even at a regulated landfill facility. All of the groundwater alternatives other than no action would be generally protective of human health and the environment, although the insitu treatment (GW4) would achieve protectiveness in a shorter time period than would those relying on the ongoing pump-and-treat effort (GW2) or even expanded pump-and-treat (GW3A and 3B).

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not an alternative complies with all state and federal environmental and public health laws and requirements that apply, or are relevant and appropriate, to the conditions and cleanup options at a specific site. If an ARAR cannot be met, the analysis of the alternative must provide the grounds for invoking a statutory waiver.

- The soil and groundwater no action alternatives do not meet ARARs. The soil no action alternative fails to address leaching, allowing contaminated soil to continue to impact groundwater at levels exceeding the MCLs. Due to the groundwater to-surface water discharge that is occurring, neither the groundwater no action alternative nor the use restrictions and monitoring option (S2) meets State and Federal ARARs regarding protection of ambient water quality in State surface waters, nor does it address potential ecological impacts to sediment originating from chromium-bearing stream water.

- Most of the other alternatives for soil and groundwater would generally meet the ARARs that would apply to the specific actions, locations, and chemicals present at this Site. However, for some alternatives, meeting ARARs may prove more difficult than others. Among the soil alternatives, for example, a RCRA cap (S2) requires consistent and regular maintenance that can be troublesome, and problems of this kind can cause failure to meet RCRA requirements. Excavation and offsite disposal (S5) could easily meet ARARs onsite, but could also introduce RCRA compliance problems at the landfill facility utilized for disposal.

3. Long-Term Effectiveness and Permanence refers to the ability of an alternative to maintain reliable protection of human health and the environment over time once the cleanup levels have been met. Since the no action alternatives do not meet the threshold criteria above (are not protective and do not meet ARARs), they are not considered further below.

- Among the soil alternatives other than the no action, the treatment or excavation alternatives (S3, S4 and S5) are rated highly. However, verifying the permanence and long-term effectiveness of solidification/stabilization (S3) requires long term monitoring, essentially forever; and there can be problems if the physical processes used to mix the affected soils and the binding/reacting agents produce a monolith that is not fully homogenous, creating "less-cured" or "less-stable" areas of the monolith that can leach. Excavation and disposal (S5) could be onsidered permanent and effective at the Site, but could pose problems over the long-term at the chosen landfill facility. Concerning insitu chemical treatment (S4), soil leachability testing performed in 1995 for the FS indicated that, once chromium is converted by treatment to the trivalent form (Cr^{3+}), it will not be re-mobilized by contact with precipitation percolating downward to the water table.

- Long-term effectiveness and permanence of use restrictions and monitoring (GW2), as well as the groundwater no action alternative, must be considered somewhat questionable in view of EPA and industry long-term experience with pump-and-treat remedies, which indicates that the performance of pump-and-treat systems often drops off substantially over time, while contaminant levels still remain above standards. This same problem (decreasing effectiveness over time) may impact Alternatives GW3A and GW3B, each of which comprises an expansion of the current pump-and-treat arrangement. While the long-term effectiveness and permanence of insitu chemical treatment (GW4) would have to be verified, onsite treatability work (as reported in the FS) supports the probability that the treatment of groundwater, once completed, will be permanent.

4. Reduction of Toxicity, Mobility, and Volume addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substance as their principal element.

- A properly constructed RCRA Cap (S2) would achieve a reduction of the mobility of soil-borne hexavalent chromium, but no reduction of its current volume or toxicity. In contrast, Alternatives S3, S4 and S5 achieve reductions in two or more of these characteristics. For S5 (excavation/offsite disposal), however, toxicity and mobility reduction assumes that some treatment would be undertaken at a disposal facility; no actual volume reduction would occur, although onsite there would be no volume remaining, since the soil would have been removed. Solidification/stabilization (S3) would be expected to reduce the toxicity and mobility of contamination, but not its volume, which would essentially equal the volume of the treatment-created monolith. Although still considered an "emerging" technology by EPA, insitu chemical treatment (S4) has the potential to reduce the toxicity, mobility, and volume of the chromium-impacted soils.

- The use restrictions and monitoring alternative (GW2) and both of the expanded pump-and-treat alternatives (GW3A, GW3B) include continued pump-and-treat for groundwater. These alternatives will achieve reduction of the volume of contamination, but very slowly and only over a long period of time, as the affected groundwater is captured by the system. No reduction in chemical toxicity of the groundwater not yet captured is achieved, although physical mobility is reduced through the system's five

pumping wells, which create a hydraulic barrier (a capture zone) that effectively prevents offsite escape of affected groundwater. In contrast, insitu chemical treatment (GW4) has the potential to reduce the toxicity of chromium-bearing groundwater by causing precipitation of the chromium onto subsurface soil particles, thus removing it from groundwater. This removes contaminant mobility and volume as well. The potential for a permanent and total removal of chromium from groundwater sets Alternative GW4 apart from the others.

5. Short-Term Effectiveness addresses the impacts of an alternative on human health and the environment during the construction and implementation phase, until remedial action objectives have been met.

- All of the soil and groundwater alternatives are rated generally even on this criterion, and no significant negative impacts are expected.

6. Implementability refers to the technical and administrative feasibility of implementing an alternative, including the availability of the various services and materials required for its implementation.

- All of the soil and groundwater alternatives should be easily implementable, in that the materials and services needed to design and construct each one are readily available. Differences among the alternatives are not significant.

7. Cost refers to the capital (primarily construction and purchase) costs for implementing an alternative, plus the costs to operate and maintain the alternative over the long term. Under this criterion, the cost-effectiveness of the alternative can be evaluated (see Table 11).

- Total present-worth cost of the soil alternatives, excluding no action, are generally in the same order of magnitude except for excavation and disposal (SS). Alternative S4, otherwise comparable to solidification/stabilization (S3), is more cost effective in that it does not create a "treatment cell" requiring long-term monitoring; successfully-treated soil would require almost no monitoring over the long term.

- Cost differences among the groundwater alternatives reflect the three general approaches described: continued IAPTS operation for as long as 30 years for about $4 million (GW1 and GW2), expand/larger IAPTS for up to 30 years for about $6.7 to 6.8 million (GW3A and 3B), or treat the groundwater (insitu chemical treatment) over five years for about $3.3 million. Alternative GW4 involves incurring more costs over the short term, but eliminates O&M costs that otherwise would be incurred during later years of operation.

8. State Acceptance addresses whether, based on its review of the RI, FS, and Proposed Plan, the State concurs with, opposes, or has no comments on the alternative proposed by EPA as the selected alternative (or "remedy").

- The State of South Carolina concurs with this selected alternative. The State's letter of concurrence is attached to this ROD as Appendix B.

9. Community Acceptance addresses whether the public agrees with EPA's selection of the alternative. Written or oral public comments, as well as informal feedback from the Proposed Plan Public Meeting or from discussions with residents, citizens or officials, are all considered in judging community acceptance.

- A public meeting was held on September 17, 1996, to present the Proposed Plan for Remedial Action at the Site to the community. The meeting was announced in an advertisement in the Columbia, South Carolina, daily newspaper, and also in a fact sheet mailed to some 600 residents, interested local officials, and others. Comments at the meeting were generally supportive of the proposed action. Although very few persons attended the meeting, EPA believes there remains strong local interest and concern from residents living near the Site and particularly around Woodcreek Lake. Extension of the public comment period was not requested.

10.0 THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, detailed analysis of the remedial alternatives, and public and state comments, EPA has selected soil Alternative S4, Insitu Chemical Treatment, and groundwater Alternative GW4, Insitu Chemical Treatment, for remediation of this Site. Upon completion of this remedy, the risks associated with the Site are projected to be below EPA's acceptable risk range of 1 X 10 -4 to 1 X 10 -6 for carcinogens and below a hazard quotient of 1 for noncarcinogens. These levels are considered protective of human health and the environment. The estimated present worth cost of the remedy, which includes $3,393,000 in capital costs and $746,000 in

O&M/monitoring, totals $4,139,000.

10.1 Description of the Selected Remedy

The remedy consists of a source control (soil remediation) component, a groundwater remediation component, a site monitoring program, and performance of the seep-area sediment removal. The sediment action is considered part of the groundwater remediation component. A remedial design will be required to plan and design the remedial action selected by this ROD.

The basic insitu chemical treatment process to be employed for both soils and groundwater is described generally in sections 8.3.4 and 8.4.5. Because insitu chemical treatment, and specifically, insitu chromium reduction, has been used at relatively few sites, the specific sequence of activities that will be performed cannot be presented in detail here, but rather, will have to be determined during a remedial design (RD) phase of work. In addition to the standard Superfund RD elements, which will be modified as appropriate for the nature and scope of this work, the RD will include, at a minimum, the following elements:

a. A plan for removal of the most-contaminated surficial soils and sludges (up to 6 inches depth) within the former wastewater ponds area, and their disposal offsite;
b. A plan for testing and evaluating the various delivery methodologies and/or strategies which could be used to place treatment solutions into contact with soil and groundwater;
C. A strategy for verifying the effectiveness and non reversibility of the chemical treatment process; and,
d. Utilization of multiple, phased actions in order to maximize the ability to modify and improve the treatment's effectiveness, as the process is implemented across the Site.

In accordance with the NCP, any modification to the selected remedy described in this ROD would be accomplished by EPA through a formal ROD modification process, such as an Explanation of Significant Differences or a ROD Amendment; and any such modification will take into account state and public comments.

10.1.1 Source Control (Soil Remediation)

After the most-impacted surficial soils and sludges currently located within the former wastewater ponds area are removed, insitu chemical treatment of the affected soils will be completed, in a phased approach to be detailed in the Remedial Design. For both soil and groundwater, the RD will be oriented towards treatability issues such as those described immediately above, rather than the "construction design" issues more common in CERCLA remedies. Anticipated treatability issues specific to soil remediation include verifying the non-remobilization of hexavalent chromium under ambient surface-soil conditions.

Available information suggests that treatment activities will require approximately one year, although this will have to be determined in the RD. Periodic soil sampling will be conducted for five years, to confirm the success of treatment. The remediation level applicable to surface soils, determined in the FS to be protective of groundwater against leaching, is 16 mg/kg hexavalent chromium (Table 10).

10.1.2 Groundwater Remediation

This component of the remedy includes a) insitu chemical treatment of groundwater, and b) continued operation of the IAPTS to capture and treat affected groundwater, and c) performance of the seep-area sediment removal.

Insitu Chemical Treatment and IAPTS Operation

As described above, an RD will be prepared to plan the specific activities by which insitu chemical treatment of chromium-impacted groundwater (and soil) will occur. Anticipated treatability issues specific to groundwater remediation include evaluating the various delivery methodologies that could be used to place reductant solutions into the aquifer to foster contact between contaminated groundwater and the solution.

Insitu chemical treatment activities are expected to require a period of approximately one to two years, and to achieve rapid reduction of hexavalent chromium to levels below the remediation

level for chromium. During this period, the IAPTS will remain operational, and gradual capture of both chromium and the other groundwater COCs will continue. IAPTS operation will maintain a hydraulically-controlled "treatment area" within which reduction/immobilization effects can be evaluated. Regular monitoring of the affected groundwater will be continued throughout the remediation process.

Successful insitu chemical treatment should bring chromium groundwater concentrations throughout the plume to levels below the remediation level (0.1 mg/l total chromium). Once this is confirmed, EPA will then reevaluate the need for continued groundwater extraction and treatment to address only the other groundwater COCs, depending on the concentrations which are still present in the aquifer at that time. This reevaluation will allow EPA to consider the need for continued pumping, as well as to consider other options, including:

- reduced or targeted pumping,
- pulse pumping at one or more wells,
- installation of additional or replacement wells,
- targeted use of any new or innovative technologies as may become available,
- modelling or evaluation of natural attenuation processes, or others.

Seep Area Sediment Removal

As described in the FS (Appendix G), a small-scale removal action will be conducted to remove the uppermost layer of sediment in a small area surrounding the seep which contains significantly elevated levels of chromium. In a simple and direct manner, this action will permanently eliminate any potential harm or effects to tributary plants and animals. The estimated volume of affected sediment is between 30 and 85 cubic yards. The action will be undertaken during the remedial action, but after EPA is satisfied that the area of effective hydraulic groundwater capture imposed by the IAPTS is sufficient to prevent sediment re-contamination from chromium-bearing stream water once the sediment action is completed.

10.1.3 Site Monitoring

A Site Monitoring Plan will be developed during the remedial design phase. As a minimum, site monitoring will include the quarterly groundwater sampling presently conducted in accordance with both the IAPTS (1994 Unilateral Administrative Order) and the current SCDHEC (state) industrial wastewater permit. The present sampling scheme consists of sampling and analysis from fifteen monitor wells, two extraction wells, and a surface water sample at the spring/seep which feeds the unnamed offsite tributary. To the current program will be added the following:

- In order to evaluate and monitor surface water quality, surface water samples will be collected and analyzed for chromium, from a minimum of one (1) "midpoint" station on the tributary, and one (1) downstream station at some distance down the unnamed tributary (both upstream of Spears Creek).

10.2 Applicable or Relevant and Appropriate Requirements (ARARs)

This section presents the ARARs which will govern implementation of the selected remedy.

10.2.1 Applicable Requirements

The following general processes and technologies are those expected by EPA to be used in implementing the remedy. Each is followed by the ARARs associated with its use. It is possible that development of new, unforeseen information about the Site during the design phase may cause modifications or additions to the listed ARARs.

Sludge generation from exsitu (current process) chromium reduction: The present remediation process includes treatment of impacted groundwater in electrochemical precipitation cells, which remove inorganic contaminants (metals, predominantly chromium) from the groundwater. The precipitation of metals generates a solid hazardous-waste sludge. This treatment process shall comply with all applicable portions of the following federal and State of South Carolina regulations:

40 CFR Parts 261, 262 (Subparts A-D), 263, and 268, promulgated under the authority of the Resource Conservation and Recovery Act.

> These regulations govern the identification, transportation, manifestation, and land disposal restriction requirements of hazardous wastes. In this case, the regulations would be applicable to the sludges which will be produced as a result of chemical treatment of groundwater pumped for treatment from the IAPTS. Sludge from the presently-used physical/chemical removal process probably constitutes hazardous waste based on its characteristics.

SC Reg. 61-79.124, .261, .262, .263 and .268, South Carolina Hazardous Waste Management Regulations, promulgated pursuant to the Hazardous Waste Management Act, SC Code of Laws, 1976, as amended.

Establishes criteria for identifying and handling hazardous wastes, as well as land disposal restrictions. These regulations are also applicable in exactly the same manner as described above for the federal hazardous waste regulations.

49 CPR Part 107, 171-179, promulgated under the authority of the Hazardous Materials Transportation Act.

Regulates the labelling, packaging, placarding, and transport of hazardous materials offsite. These regulations are applicable in the event hazardous wastes (sludges from treatment) are transported off-site for treatment or disposal.

Construction and use of monitoring or extraction wells: The ARAR listed below is applicable to all groundwater remediation activities undertaken pursuant to this remedial action which involve monitoring or extraction wells.

SC Reg. 61-71, South Carolina Well Standards and Regulations, promulgated under the Safe Drinking Water Act, SC Code of Laws, 1976, as amended.

SC Reg. 61-71 establishes standards for well construction, location and abandonment activities conducted as part of investigation or cleanup operations, at all environmental or hazardous waste sites in the State of South Carolina.

10.2.2 Relevant and Appropriate Requirements

The following regulations are considered relevant and appropriate criteria governing groundwater remediation by the method indicated.

Groundwater treatment through both insitu chemical treatment and operation of a pump-and-treat system:

40 CPR Parts 141-143, National Primary and Secondary Drinking Water Standards, promulgated under the authority of the Clean Water Act.

These regulations establish acceptable maximum levels of numerous substances in public drinking water supplies, whether publicly owned or from other sources such as groundwater. Maximum Contaminant Levels (MCLs) and Maximum Contaminant

Level Goals (MCLGs) are specifically identified in the NCP as

remedial action objectives for ground waters that are current or potential sources of drinking water supply (NCP 40 CFR § 300.430 (a)(1)(ii)(F). Therefore, MCLs and MCLGs are relevant and appropriate as criteria for groundwater remediation at this Site.

SC Reg. 61-58, South Carolina Primary Drinking Water Regulations, promulgated pursuant to the Safe Drinking Water Act, SC Code of Laws, 1976, as amended.

These regulations are similar to the federal regulations described above, and are relevant and appropriate as remediation criteria for the same reasons set forth above.

SC Reg. 61-68, South Carolina Water Classifications and Standards, promulgated pursuant to the Pollution Control Act, SC Code of Laws, 1976, as amended.

This regulation establishes classifications for water use. Additionally, the Ambient Water Quality Criteria (AWQCs) established in 40 CFR Part 131 are incorporated into SC Reg. 61-68 as numerical standards for protecting ambient water quality in state surface waters. For this reason, EPA designates this regulation as "relevant and appropriate" to surface water remediation at this site. SC Reg. 61-68 is also applicable to discharge of treated waters from the groundwater treatment system, to any surface water body.

Treatment of groundwater through the insitu chemical treatment process:

40 CFR Parts 144 and 146, National Underground Injection Control (UIC) Program, promulgated under the authority of the Clean Water Act; and,

SC Reg. 61-87, South Carolina UIC Regulations, promulgated pursuant to the SC Pollution Control Act, SC Code of Laws, 1976, as amended.

The UIC regulations outline specific requirements for injecting liquids or liquid wastes into the saturated subsurface environment, and outline a number of specific prohibitions on such actions. Since insitu chemical treatment will likely require that reductant-bearing solutions be injected or otherwise placed into the subsurface, and because the solutions could impact natural groundwaters, these regulations are considered relevant and appropriate.

10.2.3 "To Be Considered" (TBC) Criteria

The following references and regulations are designated "To Be Considered" during the design and implementation of the selected remedy:

Groundwater remediation:

Guidelines for Ground Water Use and Classification, EPA Ground Water Protection Strategy, U.S. EPA, 1986.

This document outlines EPA's policy of considering a site's groundwater classification in evaluating possible remedial response actions. Groundwater at the Site is classified by EPA as Class IIA,and by South Carolina as Class GB, indicating its potential use as a source of drinking water.

Surface water remediation via groundwater pump-and-treat (source reduction) or by insitu chemical treatment:

National Oceanic and Atmospheric Administration (NOAA) ER-L/ER-M Values, 1994, and EPA Region IV, Waste Management Division, Sediment Screening Values for Hazardous Waste Sites (2/16/94).

These guidelines were developed as screening criteria for sediment contamination in surface water bodies, and are based on toxicity to aquatic life. During the RI, exceedance of these criteria was among the factors which lead to initiation of the 1993/1994 Ecological Assessment. Although the ER-L and ER-M values (upon which the Region IV numbers are based) were not themselves intended to serve as remediation levels, they should be considered when determining an appropriate sediment remediation goal, or when judging any potential improvements in surface water quality in the offsite tributary.

40 CFR Part 131, Ambient Water Quality Criteria (AWQC) (CWA § 304), promulgated under the authority of the Clean Water Act.

These regulations set numerical criteria for ambient water quality based on toxicity to aquatic organisms and human health. The AWQCs were established to serve as "flags" indicating when site-specific ecological investigation (such as toxicity testing) is warranted. The AWQC for chromium was established in 1984. In similar fashion to the NOAA and EPA Region IV values cited above, these regulations should be considered when evaluating the impacts of groundwater pumping on the surface water quality in the offsite tributary. As noted above, State regulation 61-68 utilizes the AWQCs

established in this Federal regulation as criteria for protecting surface water quality in the offsite tributary and all State waters.

Discharge of treated groundwater to a surface water body: In the event that this discharge option is accepted by EPA and SCDHEC as the best option for disposal of treated groundwater, based upon a request from the PRP to alter the present sprayfield discharge arrangement, then the following to-be-considered ARAR would become applicable.

40 CFR Part 122, 125, 129, 133 and 136, CWA Discharge Limitations (CWA § 301), promulgated under the authority of the Clean Water Act.

Applicable to any point-source discharges of wastewaters to waters of the United States. At this Site, it is applicable to discharge of treated waters from the groundwater treatment system, to any surface water body.

SC Reg. 61-68, South Carolina Water Classifications and Standards, promulgated pursuant to the Pollution Control Act, SC Code of Laws, 1976, as amended.

These regulations establish classifications for water use, and set numerical standards for protecting state waters. SC Reg. 61-68 is also applicable to discharge of treated waters from the groundwater treatment system, to any surface water body.

Discharge of the treated groundwater to a Publicly Owned Treatment Works (POTW): In the event that this discharge option is accepted by EPA and SCDHEC as the best option for disposal of treated groundwater, based upon a request from the PRP to alter the present sprayfield discharge arrangement, then discharge of treated water will be accomplished in compliance with the following ARAR:

40 CFR § 403.5, CWA Pretreatment Standards (CWA § 307), promulgated under the authority of the Clean Water Act.

Regulates discharges of water to POTWs. This regulation would be applicable to discharge of treated waters from the groundwater treatment system to a local POTW.

SC Reg. 61-68, South Carolina Water Classifications and Standards, as cited above.

These regulations establish classifications for water use, and set numerical standards for protecting ambient water quality in state waters. SC Reg.61-68 is also applicable to discharge of treated waters from the groundwater treatment system to a local POTW.

10.2.4 Other requirements

Remedial design often includes the discovery and use of unforeseeable but necessary requirements. Therefore, during design of the selected remedy, EPA may elect to designate further ARARs which apply, or are relevant and appropriate, to the remediation of soil, sediment, groundwater, or surface water at this Site. This would be done through a formal ROD modification process such as an Explanation of Significant Differences (ESD) or a ROD Amendment.

10.3 Performance Standards

The standards defined in this section comprise the performance standards defining successful implementation of this remedy:

A. The RLs listed in Table 10 on page 56 of this ROD are performance standards.

B. Treated groundwater generated by continued operation of the IAPTS shall meet the applicable State of South Carolina permit requirements, which are performance standards for purposes of this remedy also.

C. As a performance standard, groundwater remediation performed under this remedy shall prevent or control the offsite migration of all groundwater containing, the Site COCs at levels above their respective Rls, until such time as the groundwater quality meets the Rls as listed in Table 10.

It is expected that the remedial design process will lead to the establishment of more process-specific performance standards for the insitu chemical treatment process. In combination with the general performance standards listed above, these process-specific performance standards will allow EPA and SCDHEC to better judge the extent and degree of success accomplished by insitu treatment and the remedy as a whole.

10.4 Variations from the Proposed Plan

During preparation of this ROD, certain discrepancies between the Proposed Plan (September 1996), the FS Fact Sheet (July 1996), and

this document became apparent. None of these are significant to the overall scope and content of the selected remedy.

1. The FS contemplated the use of a remediation level equivalent to the Federal chronic AWQC for hexavalent chromium, 0.011 mg/l, based upon South Carolina Regulation 61-68, which uses the Federal AWQCs as criteria for protecting ambient water quality. In December 1996, at EPA's request, SCDHEC calculated a new acceptable surface water standard for the offsite tributary that is consistent with SC Regulation 61-68, which is 0.040 mg/l. The surface water RL is discussed further in the Responsiveness Summary to this ROD (Appendix A).

2. Concerning Site monitoring, since the time of the Proposed Plan, EPA has decided that periodic sampling of surface water from a midpoint station, as well as from a downstream station, is required. The Proposed Plan calls only for a sample from one downstream sample point on the unnamed tributary.

3. The Proposed Plan fact sheet has the MCL for cadmium listed as 100 ug/l, which should read 5 ug/l.

4. The risk levels presented in Table 9 are slightly different from those shown on page 5 of the Proposed Plan due to a mathematics error.

11.0 STATUTORY DETERMINATIONS

EPA and the State of South Carolina believe that the selected remedy achieves the best possible balance of trade-offs in terms of long-term effectiveness and permanence, reduction of toxicity/ mobility/volume, short-term effectiveness, implementability, and cost. The selected alternative is superior to the other alternatives in reducing toxicity/mobility/volume; is as easily or more easily implementable; and is the most cost-effective choice.

In addition to these considerations, section 121(b)(1) of CERCLA, 42 U.S.C. § 9621(b)(1), requires that a selected remedy must protect human health and the environment; meet ARARs (unless waived); be cost-effective; use permanent solutions, and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and finally, wherever feasible, employ treatment to reduce the toxicity, mobility or volume of the contaminants. The selected remedy for this Site meets all of these statutory requirements, as described below.

Protection of human health and the environment: The remedy will reduce and eventually remove future human health risks from ingestion of contaminated groundwater. This will be accomplished through implementation of an insitu chemical treatment program for Site soils and groundwater, and continued operation of the existing groundwater pump-and-treat system (the IAPTS). Upon completion of this remedy, the risks associated with the Site are projected to be below EPA's acceptable risk range of 1 X 10 -4 to 1 X 10 -6 for carcinogens and below a hazard quotient of 1 for noncarcinogens.

During the insitu treatment period, operation of the IAPTS will prevent the offsite migration of contaminated groundwater which otherwise could migrate offsite toward private water wells. Additionally, reduction of the amount of groundwater-borne chromium entering the tributary, and completion of the sediment removal action, should positively impact tributary ecology.

Compliance with ARARs: The selected remedy will meet all of the State and Federal ARARs listed in Section 10.2. of this ROD. No waivers of Federal or State requirements are anticipated at present.

Cost effectiveness: The remedy is cost effective in that it is expected to achieve permanent chemical alteration and detoxification of the treated groundwater and soil, thereby eliminating long-term O&M costs expected under other alternatives.

Utilization of permanent solutions, and alternative treatment technologies or resource recovery technologies to the maximum extent practicable: The selected remedy represents the maximum extent to which permanent solutions and treatment can practicably be used for this action. It employs an innovative technology, insitu chemical treatment, to permanently reduce contaminant concentrations in both soil and groundwater. The remedy has the potential to achieve permanent reductions of groundwater toxicity, mobility and volume in a reasonable period of time (5 years or less). The remedy soil component, also utilizing insitu chemical treatment, accomplishes permanent treatment rather than creating a treatment cell or generating large quantities of material requiring landfill disposal.

Preference for treatment as a principal remedy element: The selected remedy employs direct treatment of contaminated soil and groundwater as the principal element of the action. Continued operation of the existing groundwater pump-and-treat system will also contribute toward fulfilling the preference for treatment as a principal element, though at a slower pace, through extraction and treatment of contaminated groundwater.

RESPONSIVENESS SUMMARY
TOWNSEND SAW CHAIN COMPANY SITE

1. Overview

The U. S. Environmental Protection Agency (EPA) held a public comment period from September 6, 1996 to October 7, 1996, for interested parties to comment on the Remedial Investigation/ Feasibility Study (RI/FS) results and the Proposed Plan for Remedial Action at the Townsend Saw Chain Company Site in Pontiac, Richland County, South Carolina. During this period there were no requests to extend the comment period for an additional 30 days.

EPA and the South Carolina Department of Health and Environmental Control (SCDHEC) hosted a public meeting at 7:30 p.m. on September 17, 1996, at Pontiac Elementary School in Pontiac, South Carolina at which the results of the RI/FS, the current status of pump-and-treat operations under the Interim Remedial Action, and the Proposed Plan for the final Remedial Action were presented. Both at this meeting and in the Fact Sheet which preceded it, local citizens were told that the major purpose of the meeting was to receive comments and questions from the public.

EPA proposed a selected remedy comprising the following components:

- SOIL TREATMENT (Source Control): Alternative S4
  - Insitu Chemical Treatment of surficial soils
- GROUNDWATER REMEDIATION: Alternative GW4
  - Insitu chemical treatment of groundwater
  - Continued operation of the Interim Action Pump and Treat System (IAPTS)
  - Sediment removal action at the Seep (Offsite Area)
- SITE MONITORING
  - Continued quarterly sampling/analysis of Site groundwater
  - Additional quarterly sampling of surface water in the unnamed offsite tributary
  - Periodic sampling of treated Site soils

EPA's "Proposed Plan Fact Sheet" was mailed to an estimated 600 individuals on the Site mailing list. Attendance at the Proposed Plan Public Meeting was very light. Based on the submission of only one set of written comments during the public comment period, and the absence of comments at the meeting, EPA believes the residents and local officials in the Pontiac, South Carolina area support the actions proposed by EPA and SCDHEC.

This Responsiveness Summary provides a summary of citizens' comments and concerns identified and received at the September 17, 1996 public meeting and during the public comment period, and EPA's response to those comments and concerns. The following sections and attachments are included herein:

- Background of Community Involvement

- Summary of Comments Received During the Public

Comment Period and EPA's Responses

- Attachment A: Proposed Plan for Townsend Saw Chain Company Superfund Site
- Attachment B: Public Notice of Public Comment Period
- Attachment C: Letter (Public Comment) Concerning the Proposed Plan
- Attachment D: Proposed Plan Public Meeting Sign In Sheets
- Attachment E: Official Transcript of the Proposed Plan Public Meeting

2. Background of Community Involvement

EPA's community relations program for the Site began in December of 1991, when EPA conducted community interviews with local residents and officials in order to develop a community relations plan for the Site. At that time, the main concerns expressed by residents living in areas near the Site were as follows: (1) the possibility of health threats to children attending Pontiac Elementary School, which is located approximately 500 feet northwest of the Site; and (2), concerns from persons living near, particularly east of, the Site. Many residents were surprised to learn that a final overall cleanup was not, in fact, already underway, and asked why the cleanup is taking so long.

EPA personnel conducting the interviews, including the Remedial Project Manager (RPM) and the Community Relations Coordinator (CRC), explained the current status of Site work at that time, why the Site was to be investigated under Superfund, and what would occur once field work began.

An RI "kickoff" public meeting was held by EPA at Pontiac Elementary School on April 22, 1992. Approximately 70 persons attended this meeting. Public questions and concerns centered around the proximity of the Site to Pontiac Elementary School, and the long period of groundwater cleanup that had been ongoing without completion of the cleanup effort. EPA staff explained the lack of any health threats to school children based on then current knowledge of the Site, and that the RI work included verifying the absence of any such threats. EPA and SCDHEC officials also explained the specific details of Homelite Textron's groundwater remediation activities, and EPA's plans and objectives concerning groundwater contamination.

During the summer of 1993, after completion of RI Phase II field work, EPA and SCDHEC determined that an Interim Remedial Action to address offsite groundwater contamination was warranted in view of inconclusive data concerning the full downgradient, offsite extent of Site-affected groundwater, and the likelihood of continuing offsite migration of contaminated groundwater. EPA prepared an August 1993 Proposed Plan Fact Sheet to publicly propose the Interim Remedial Action and to solicit public comments. The fact sheet also announced the opening of a 30-day public comment period on August 20, 1993. A notice to area citizens announcing the August 31, 1993, Proposed Plan public meeting and the upcoming public comment period was published in Columbia's daily newspaper, The State, on August 20, 1993.

An Interim Action Proposed Plan public meeting was held on August 31, 1993, at Pontiac Elementary School. Approximately 70 persons attended the meeting. EPA officials explained that the Interim Action consisted of a hydrogeologic study in the offsite area to define the extent of contamination, followed by expedited design and construction of an extraction and treatment system to capture and treat the affected groundwater and prevent continued offsite movement. As detailed in the Responsiveness Summary of the December 1993 Interim Record of Decision, the public expressed a great deal of interest in the Interim Remedial Action. Most questions concerned EPA's planned precautionary sampling of four private water wells at the southwest end of woodcreek Lake. In response to these concerns, water wells belonging to a group of residents belonging to the homeowners, group were sampled in September 1993 and again in July 1994 in joint EPA-SCDHEC efforts. Also as a precaution, Textron sampled 7 private wells located along the south side of Interstate Highway 20 although not in the known direction of groundwater movement. Sample results from the I-20 and Woodcreek Lake wells have indicated, in all cases, non-detects or far below levels of concern for inorganic contaminants (such as chromium) and volatile organic compounds (VOCs).

A notice publicizing the issuance of the Interim Record of Decision was published in The State in May 1994. Throughout 1994 and 1995, EPA maintained ongoing contact with the local homeowners' group (at Woodcreek Lake), as well as the business partnership which owns all of the affected offsite property.

Following issuance of a fact sheet, EPA held a public meeting on April 27, 1995, to update local residents and the public concerning the results of the offsite hydrogeology work and plans for the offsite pump-and-treat system. Attendance at this meeting was very light and no significant concerns were expressed.

In July 1996, prior to finalizing the FS, EPA issued a fact sheet describing the technologies and remedial alternatives for final cleanup of the Site. The fact sheet also requested public input on the alternatives and initial evaluation of them. After finalization of the FS, a Proposed Plan Fact Sheet was issued in early September 1996 describing EPA's selected remedy and announcing a September 17, 1996 public meeting. Attendance at this meeting was very small and no concerns about the proposed action were expressed.

In summary, since late 1994, public attention concerning the site has been very limited. The Site has received only infrequent coverage in the one major newspaper published in the area. There have been occasional requests to be added to the Site mailing list, which has been expanded and now includes some 600 persons and businesses.

3. Summary of Comments Received During the Public Comment Period and Acency Responses

The Public Comment Period opened on September 6, 1996, and was closed on October 7, 1996. The Public Notice which was published in the area's local paper, The State, can be found at Attachment B.

As noted above, on September 17, 1996, EPA held a public meeting to present the Proposed Plan for the Site to the community and to receive comments. No comments by the public were expressed at this meeting, which was very lightly attended.

One letter was received during the public comment period, from SECOR International, the consultant for the Potentially Responsible Party (PRP). The letter (Attachment C) concerns one specific technical question, as discussed below.

Comprehensive Response to Specific Legal or Technical Question

The letter received during the comment period (Attachment C) concerns EPA's selection of a surface water remediation level (RL) for the Site, based on the Feasibility Study.

The main point expressed in the PRP consultants' letter is that the FS surface water remediation level (referred to as "remediation goal in the FS), 0.011 milligrams per liter (mg/1) total chromium, is overly conservative, in view of the following:

- The RL is not based on site-specific data but rather on the Ambient Water Quality Criterion (AWQC) for hexavalent chromium, and ignores site-specific Ecological Assessment results;

- The AWQC of 0.011 mg/1) is intended to account for the effects of hexavalent chromium only;
- The much-less-toxic trivalent form of chromium is expected to predominate in the tributary, and sufficient organic matter is present to reduce the hexavalent chromium to the trivalent state;
- No adverse effects were noted to the test species in the EA until a concentration of 0.049 mg/l chromium, more than 4 times the RL, was present; and finally,
- The AWQCs have not been revised since 1985 and thus do not incorporate any more recent scientific findings concerning freshwater toxicity.

The letter suggests that a final surface water remediation level be identified later, after groundwater remediation activities have taken place, and notes that the two environmental consulting firms that performed the EA "recommended performing no active remediation of the surface water and sediment in the offsite tributary, as the impacts are only slight to moderate and the treatment of the onsite groundwater...will likely result in the mitigation of the chromium in the offsite tributary."

RESPONSE: EPA agrees that, when feasible and when done in compliance with applicable or relevant and appropriate requirements (ARARs), data from site-specific studies should be used to establish remediation or cleanup standards to be met by the selected alternative. For this reason, the issue was revisited during preparation of the Record of Decision (ROD).

To establish a cleanup standard for surface water, in addition to the toxicity data from the Ecological Assessment, EPA must consider State and Federal ARARs for surface water. As described in section 10.2 of the Record of Decision, EPA and SCDHEC do not use the Federal AWQCs in the same manner: SCDHEC uses the AWQCs as numerical criteria in all State surface waters. In accordance with the NCP, EPA must consider State ARARs in determining cleanup standards, whether such ARARs are more, or less, stringent than those promulgated by EPA. In consultations with EPA concerning its concurrence with the proposed remedy, SCDHEC indicated that an acceptable surface water standard must be based upon the AWQC in order to maintain intra-state consistency and legal integrity within their statewide water protection program.

At the request of EPA, SCDHEC investigated potential cleanup criteria based upon the AWQC, and calculated that a level of 0.040 mg/l chromium (measured as hexavalent or total) would be protective of aquatic flora and fauna in the offsite tributary. This calculation was performed in a similar manner as would be done for a permit under the National Pollution Discharge Elimination System (NPDES). In accordance with the Prothro

Amendment to the Clean Water Act, the calculation accounts for the presence of dissolved solids in the stream water and utilizes the Suspended Solids Partitioning Method. The calculation by SCDHEC is as follows:

$C_t = C_d \times (1 + K_d \times TSS \times 10^{-6})$

where
- Ct = Total instream chromium concentration after mixing
- Cd = Criteria x measured percent dissolved considered most relevant in fresh water (0.011 x 0.95 = 0.01 mg/l)
- TSS= Total suspended solids (total instream solids after mixing) 10 mg/l
- Kd = Chromium partition coefficient = 3×10^{-5} l/kg

$$C_t = 0.01\ (1 + 3 \times 10^{-5} \times 10 \times 10^{-6})$$
$$= 0.01\ (1 + 3)$$
$$= 0.040 \text{ mg/l or } 40 \text{ ug/l}$$

EPA is selecting this value as the remediation level (RL) for surface water for the following reasons. First, it is close to, but still slightly below, the lowest adverse effects level (LOEL) determined in the Ecological Assessment, 0.049 mg/l. This represents a comparison with, and usage of, site-specific data. The 0.040 mg/l RL is also consistent with the methods by which other surface water discharge requirements throughout the State of South Carolina are determined, and meets the State ARAR for ambient surface water quality. (This latter point, consistency, is appropriate because the continuing contaminated groundwater discharge to surface water can reasonably be considered an ongoing discharge). Finally, the RL is not equivalent to the hexavalent chromium AWQC itself, which accords with the fact that the AWQCs were not originally intended by EPA to serve as cleanup criteria.

Concerning other points raised in the letter, EPA acknowledges that the surface water RL may need to be reevaluated in light of new information during remedial design or remedial action. We do not agree that it is appropriate to wait until the groundwater remedial action is underway or complete to determine a surface water RL. As described in the ROD, both the near-future insitu chemical treatment, and the presently ongoing operation of the groundwater pump-and-treat system, are intended to impact surface water and reduce chromium concentrations. EPA does not agree that no active remediation of the surface water and sediment in the offsite tributary take place; we have, however, acknowledged the difficulty in determining a well-supported sediment remediation level, and based on discussion with all parties, have selected a limited sediment action appropriate to the scale of the problem. At the time the "no active remediation" recommendation was made, the full range of chromium concentrations present in the seep-area sediment was not known

(up to 1,647 mg/l total chromium in sediment samples). Finally, EPA agrees that operation of the groundwater pump-and-treat system will likely improve surface water, and is requiring this as part of the selected remedy.

<IMG SRC 97019M>

INTRODUCTION

The United States Environmental Protection Agency (EPA), Region IV, has prepared this fact sheet to propose a final cleanup plan to address environmental contamination at the Townsend Saw Chain Company Superfund Site ("the Site"), in Pontiac, South Carolina. EPA is the lead Agency for remedial activities at the Site, and, in cooperation with the South Carolina Department of Health and Environmental Control (SCDHEQ, is overseeing environmental investigation and cleanup of the Site. Presently, the Site poses no risks to workers or residents living nearby. However, in the event groundwater was used as a potable water supply in the future, there could be risks posed through consumption of groundwater from wells located within the affected area.

The selection of a cleanup plan to address this Site represents a preliminary decision by EPA, subject to a public comment period. SCDHEC has informally concurred with EPA's selection. However, a final decision will be made by EPA

only after all public comments have been reviewed and considered.

As outlined in section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, known as "Superfund"), as amended by the Superfund Amendments and Reauthorization Act of 1986, EPA encourages public participation by providing an opportunity for the public to comment on the proposed remedial actions. As a result of such comments, EPA may modify or change its preferred alternative before issuing a Record of Decision for the Site. Further information concerning opportunities for public participation can be found on page 14.

Recent activities at the Site have included the completion of a Feasibility Study (FS) for the Site. The FS is a report in which all of the cleanup technologies and cleanup plans which could be used to address Site contamination, are evaluated and compared, in order to support EPA's selection

PUBLIC MEETING
Proposed Plan for Final Cleanup
of the Townsend Saw Chain Superfund Site
Tuesday, September 17, 1996 - 7:30 p.m.
PONTIAC ELEMENTARY SCHOOL
500 Spears Creek Church Road, Pontiac, South Carolina

THIS PROPOSED PLAN:

1. Presents a summary of Site background and the nature and extent of Site contamination;
2. Describes EPA's evaluation of available alternatives for Site cleanup, and provides a summary

analysis explaining why EPA is proposing its preferred alternative; and
3. Requests public review and comment on this course of action, including how to get more information and where to send your comments.

of the best plan for the Site ("the remedy"). The purpose of this fact sheet is to present EPA's preferred remedy for the Site, and request public review and comment on the planned course of action (known as "the Proposed Plan"). Your questions and comments should be directed to the EPA and SCDHEC staff working on this Site, who are listed on page 14 of this fact sheet. The location of the information repository, which contains the Remedial Investigation (RI) Report and other reports, correspondence and documents concerning the Site, is also listed on page 14.

This fact sheet is also intended to supplement the recently issued "Feasibility Study Fact Sheet, Townsend Saw Chain Superfund Site" (July 1996). Please refer to that document, or to the FS document itself (page 14), for a more detailed presentation of the other remedial alternatives not selected by EPA for use at the Site.

Scope and Role of This Action: The action EPA is proposing in this Proposed Plan will address all of the principal environmental risks associated with the Site. These are (1) potential long-term human health risk in the offsite area (across SC Road 53) from exposure to contaminated groundwater, if groundwater were used as a potable water source, and (2) potential long-term ecological effects to the ecosystem along the

unnamed offsite tributary to Spears Creek (offsite area).

RESULTS OF SITE CHARACTERIZATION

Site description and Recent Site Work: The Townsend Saw Chain Site is located along the north side of Interstate highway 20 at the SC Road 53 exit (Pontiac), approximately 10 miles northeast of Columbia, South Carolina. Groundwater, surface water, soil and sediment contamination at the Site resulted from past wastewater disposal operations at the onsite manufacturing facility. The main Site contaminant is hexavalent chromium (Cr 6+). The property has been owned since September 1994 by Deere and Company (John Deere). Two former owners/operators, Textron, Inc. and Dictaphone Corporation (Pitney-Bowes), are responsible under Superfund for environmental cleanup work at the Site. Between 1992 and 1994, Textron, Inc. conducted a Remedial Investigation (RI) at the Site, with EPA and SCDHEC oversight. A 1994 Interim Remedial Action, designed to prevent further offsite migration of contaminated groundwater, was essentially completed in December 1995 with the construction and start-up of the 5 well Interim Action pump-and-treat system (IAPTS). Site soil contamination, and offsite surface water and sediment contamination,

were investigated further during 1995. The findings from this additional work are included in the FS, which evaluates cleanup plans and technologies which could be used to address all Site-related contarnination. This document is available for public review as described on page 14.

Groundwater contamination has been, and remains, the main environmental problem at the Townsend Saw Chain Site. The Remedial Investigation and subsequent work has confirmed that a large area underlain by contaminated groundwater is present, both on the Deere & Company (formerly Homelite Textron) plant and extending approximately 700 feet offsite, northeast of the property boundary along Spears Creek Church Road (SC Road 53; see Figure 1 below).

The main Site contaminant is hexavalent chromium (Cr 6+), which occurs at levels from the detection limit up to approximately 4 Milligrams per liter (mg/l). Nitrates occur in several wells above water quality standards, and trace-level volatile organic compounds (VOCs) also occur in several wells. The VOCs occur inconsistently and do not form a defined plume; a typical combined concentration, at any one well, is less than 0.100 mg/l. The contaminant plumes of all of these substances are found in the shallow aquifer, and are located approximately within the chromium groundwater plume shown in Figure 1.

As stated above, the limit of groundwater contamination is approximately 700 feet northeast of SC Road 53. There are private water supply wells located approximately one mile

<IMG SRC 97019N>

downgradient of this point; none of these wells has shown any impact to date. There is also a small tributary which is fed almost entirely by groundwater. In summary, based on RI and post RI groundwater quality data, the main potential pathways through which contaminated groundwater could pose a risk to human health or the environment, are 1) through consumption of impacted well water (human health) if groundwater were used as a drinking water source, and/or 2) potential damage to the offsite tributary-area ecosystem through any toxic effects attributable to site contaminants in surface water (surface water is discussed below).

Soil contamination, by hexavalent chromium, is present mainly in the former wasteponds area, as indicated on Figure 1. Contamination is limited to the uppermost 1/2-foot of surface soil. The levels present, up to 279 mg/kg but generally much lower, do not pose a health threat to onsite workers, but are likely to be impacting groundwater through leaching. Two other small "hotspot" areas of soil contamination are being excavated and disposed of under the Interim Remedial Action, and are thus not addressed in the FS.

Surficial sediment around the seep which feeds the offsite tributary, contains elevated levels of chromium. Based on work conducted in late 1995, the sediment appears to be binding up chromium in its less-mobile trivalent form (Cr 3+). Sediment toxicity testing and biological evaluations conducted in the 1994 Ecological Assessment (EA), partly intended to generate a sediment cleanup goal, were inconclusive. In EPA's judgement, while not of concern as a human health risk, the chromium levels could nonetheless pose a long-term environmental hazard to plants and animals in and along this area. Therefore, a small-scale action to address this sediment is warranted. The EA work on sediment toxicity demonstrated the technical difficulties in accurately determining a sediment

cleanup goal, and for this reason, a specific number will not be set.

Surface water was also evaluated in the EA, which concluded that chromium-bearing surface water in the tributary could potentially cause an impact to the stream ecosystem, although the results were not conclusive. While clear-cut ecological effects are difficult to identify with certainty, the EA was more conclusive in showing that any potential effects are limited to the upper portions of the tributary, and do not extend to Spears Creek.

RISK ASSESSMENT RESULTS

As part of the 1992-1994 RI, a Baseline Risk Assessment was completed by an EPA contractor (Dynarnac Corporation) in 1993. The Assessment used analytical data from phases 1 and 2 of the RI. In 1994 and 1995, in support of the Interim Remedial Action and the Feasibility Study, additional soil and groundwater data was generated. This new data, as well as new EPA policy guidance concerning land use in the risk assessment process, were used in Section 1.5 of the recently-completed FS to revise the overall, picture of human health risk attributable to the Site.

The Baseline Risk Assessment, as modified by the 1996 Addendum to the Baseline Risk Assessment (Appendix B in the FS), describes the risks to human health which would result if the contamination present at the Site is not cleaned up. The assessment proceeds in a series of steps. FM a list is generated of AU the chemicals present and their concentrations. Next, the Assessment considers the present and future population living on the Site - in this case, workers at the manufacturing facility, Site visitors or trespassers, and offshe residents (children and adults). Then, from the present-use and likely future-use scenarios, "pathways" through which persons

could be exposed to the contaminants are developed. Exposure pathways at a Site can include, for example, dermal (skin) contact with contaminated soil, ingesfion of contaminated soil, or ingestion of contaminated groundwater.

The pathways of exposure are then developed by making assumptions such as the length and number of times exposed, how much of the chemical is ingested, along with certain other factors. Thus a calculation can be made using known effects and reasonable exposure assumptions, and the health effects caused by the contaminant. For each pathway, two calculations are made to account for the two general types of contaminants: carcinogens, suspected or known to cause cancer, and noncarcinogens, substances which are hazardous and cause damage to human health through other effects.

For carcinogens, the result is expressed as the excess cancer risk posed by Site contan-driants. EPA has established a range of 1 x 10 -4 to 1 x 10 -6 as acceptable limits for lifetime excess carcinogenic risks. Excess risk in this range means that between one person in 10,000 (1 x 10 -4) and one person in one million (1 x 10 -6) will risk developing cancer during a lifetime of exposure. For each pathway and each medium, the cancer risk from each individual contaminant is added together, because in a "worst case" scenario a person could be exposed through several or all of the possible pathways.

Noncarcinogenic risk is expressed as a Hazard Quotient (HQ). The HQ is ratio of the amount of the chemical taken in, divided by the reference dose, which is an intake amount below which no adverse effects are known to occur. As for cancer risk, for each pathway and medium, the HQs for the individual contaminants are added together, giving a summary figure, the Hazard Index (HI). EPA generally requires that remedial actions be taken at sites which have a current land use HI, or future use HI, that is greater than 1.0.

Carcinogenic risk and noncarcinogenic HIs were calculated for both (1) the current land use scenario, with plant workers on the Site property and no current residents in the offshe area, and (2) the anticipated future use scenario, which is continued light industrial use at the facility, with commercial use along SC Road 53 and residential land behind (northeast of) the commercial-use strip.

The current situation at the Site has a total carcinogenic risk of 4 x 10 -7, which is below (less than) the lower end of the acceptable risk range. The toial noncarcinogenic risk is HI = 0.2, also below EPA's acceptable limit (HI = 1.0). This means that there are currently no health risks posed to onsite workers, and, because there is no current groundwater usage within the affected area, no health risks to nearby residents through the use of contaminated groundwater.

Exclusively because of potential risk from drinking contaminated groundwater, the future use scenario, under which offshe residents could use groundwater as a water supply, carries a carcinogenic risk of 8 x 10-5 for adults; 5 x 10 -5 for a child resident, which is within the range allowing EPA to undertake, or require, remedial action (that is, excess risk of between 1 x 10 -4 to 1 x 10 -6). For noncarcinogenic risk, the future use HI is 111 for the child resident, 46 for the adult, which is above the EPA "action" benchmark of 1.0. The majority of the risk is posed by groundwater impacted by hexavalent chromium. There are no future human health risks from offshe sediment or surface water in the offsite area (including all offske area zoned residential). In summary, the primary long-term human health risk pathways at the Townsend Saw Chain Site are:

• a Present Land Use: None.

Future Land Use: Ingestion of groundwater
(carcinogenic and noncarcinogenic risk.)

A more detailed presentation on how Site risks are evaluated is presented in the Baseline Risk Assessment, which is available at the information repository described on page 14. The reader should keep in mind that the FS revises the portion dealing with Site soils, and that the FS presents the most up-to-date overall assessment of Site risks.

GOALS OF THE CLEANUP

Under Superfund, the selected remedy for a site must protect human health and the environment, and must meet all of the state and federal requirements which would apply to such an environmental cleanup action. In the FS, from this starting point, general remedial action objectives, and eventually site-specific remediation goals (also called cleanup standards or cleanup goals, i.e., specific numbers), are developed.

The general objectives for remediation of each of the impacted media (soil, groundwater, surface water, and sediment) at the Site are to prevent ingestion of, or contact with, those chemicals of concern at levels that pose unacceptable health risks (human or ecological). Additionally, since contamination in one medium can affect another, there are a number of additional goals, as follows:

Soil: Prevent the leaching of contamination into groundwater, which can render the groundwater unfit for use as a water supply resource.
Groundwater: 1) Prevent or reduce the continued discharge of contaminated groundwater to surface water, such that surface water quality standards are exceeded; 2) Reduce concentrations of chemicals of concern so that normal productive use (as a potable water supply) is restored, if possible.
Sediment: Prevent exposure of the tributary ecosystem to chromium, and/or reduce levels of the chromium such that no unacceptable ecological risks are presented (not a human-health risk).

Surface water: Reduce contamination to levels which 1) cannot pose ecological risk to tributary plants and animals, and 2) are incapable of re-contaminating tributary sediment.

The Feasibility Study Fact Sheet (July 1996) presented a summary of the process by which Chemicals of Concern (CCS) and remediation goals were established, which will not be repeated here. The remediation goals for the Site are presented below in Table 1.

TABLE 1 - REMEDIATION GOALS
TOWNSEND SAW CHAIN CO. SITE

Surface Soil (1)	Chromium +6	16 mg/kg
Surface Water	Chromium (2)	0.011 mg/l
Groundwater (3)		
	Chromium (total)	0.100 mg/l
	Cadmium	0.100 mg/l

Cyanide	0.200	mg/l
Lead (4)	0.015	mg/l
Manganese (5)	0.078	mg/l
Nitrate	10.0	mg/l
Vanadium (5)	0.110	mg/l
1,1-dichloroethylene	0.007	mg/l
Trichloroethylene	0.005	mg/l
Tetrachloroethylene	0.005	mg/l

(1) Remedial goal is for the protection of groundwater from leaching. This remediation goal was determined from leaching tests using Silt soils and a target groundwater level of 0.100 mg/l, the State and Federal Maximum Contaminant Levels (MCL) for chromium

(2) State and Federal chronic ambiant water quality criterion (AWQC) for chromium, mesured as total Cr. This goal a for the protection of the ecosystem in and along the offsite tributary. There is no human health threat associated with chromium in surface water. There is used in this case due to the lack of conclusive and verifiable information regarding impacts to tributary plants and animals; it is not based on site-specific information.

(3) All goals represent State and Federal Maximum Contaminant Levels (MCLs),under the Safe Drinking Water Act (1974), except as indicated in (4) and (5) below:

(4) EPA Action Level
(5) Baseline Risk Assessment, Townsend Saw Chain Site.

ALTERNATIVES FOR SITE REMEDIATION

Cleanup options. Technologies which could be considered for Site cleanup operations are described in detail in the FS. Each was then screened against a number of criteria, including Site soil and waste characteristics, limitations of the technology, its technical effectiveness, ease or difficulty of implementation, and cost effectiveness. The technologies which passed screening were assembled into five soil and four groundwater remedial alternatives. These alternatives are described and evaluated in detail in the FS, and were presented in summary form in the recent "Feasibility Study Fact Sheet" issued by EPA in July, 1996. From these alternatives, EPA is selecting one groundwater alternative and one soil alternative as its "preferred alternative," or remedy, for remediation of the Site. All of the remedial alternatives are summarized in Table 2 below.

Although the table refers to "soil" and "groundwater" alternatives, it should be noted that the sediment removal action described earlier, and continued operation of the Interim Action Pump-and-Treat System (IAPTS) to reduce surface water contamination, are included within all.

Selecting a preferred allemative. The FS compares the alternatives to each other, based on the nine criteria EPA uses to evaluate whether a remedial alternative can be chosen as the Site remedy. These criteria include:

1. Overall Protection of Human Health and the Environment.
2. Compliance with ARARs.

These two criteria are considered "threshold criteria" and must be met in order for an alternative to be selected.

Five primary balancing criteria are used to further choose the best alternative, from those which meet the above two criteria:

3. Long-Term Effectiveness and Permanence.
4. Reduction of Toxicity, Mobility, or Volume.
5. Short-Term Effectiveness.
6. Implementability.
7. Cost Effectiveness.

The last two criteria are intended to address any technical or administrative issues and concerns the State may have regarding a selected alternative, and potential issues and concerns the public may have regarding the selected alternative:

8. State Acceptance.
9. Community Acceptance.

At this time, SCDHEC has informally indicated its concurrence with this Proposed Plan. DHEC personnel are preparing formal comments on both the FS and the Proposed Plan. Public and community acceptance of the selected alternative will be assessed thoroughly during review of any comments EPA and the State receive on the FS and the Proposed Plan.

EPA'S PREFERRED ALTERNATIVE
(SELECTED REMEDY)

EPA is proposing to select Alternatives S4 and GW4, both of which call for insitu chemical treatment of soil (S4) and groundwater (GW4) as the selected remedy. The remedy also includes operation of the IAPTS, and the sediment removal action (ecosystem protection)as described in the FS.

Rationale. Alternative S4 (Insitu Chemical Treatment) is judged best among the soil alternatives. In summary, although Alternatives S3 (Solidification/Stabilization) and S5 (Excavation and Offsite Disposal) are reasonable

TABLE 2 - REMEDIAL ALTERNATIVES
TOWNSEND SAW CHAIN CO. SITE

S1 NO ACTION

No actions taken. This would allow soils capable of leaching chromium to continue to affect groundwater and possibly lengthen the time necessary to complete the cleanup. Site mmediation goals as wells as state and federal environmental requirements would not be met. Costs, which consists of a status report every 5 years, total $34,000.

S2 RCRA CAP

The area of affected soils would be capped with a multilaycr cover, and graded and vegetated for proper drainage. This alternative would prevent contact with the soil contamination and reduce or prevent leaching to groundwater. Long-term effectiveness and permanence may be questionable, as is the degree to which all of the requirements (ARARs) would be met. 4 Total costs are approximately $586,000.

S3 SOLIDIFICATION/STABILIZATION

The area of affected soil would be physically mixed and chemically treated to immobilize soil chromium. A solid mass resistant to weathering, or "monolith," remains in place and is monitored to insure that it does not leach to groundwater. This alternative would generally meet the Site remedial goals, although there is some question regarding long-term effectiveness and permanence. Total costs are $810,000.

S4 INSITU CHEMICAL TREATMENT

Liquid solutions containing a reducing agent are percolated into affected (surface) soil and into contact with soil-borne hexavalent chromium. The resulting reaction "locks up" the chromium in a non-toxic, immobile form incapable of contaminating groundwater.

This alternative can meet the Site remedial goals, and is cost-effective in attaining them. Total costs are $857,000.

S5 EXCAVATION AND OFFSITE DISPOSAL

Affected soils, which comprise approximately 2,600 cubic yards, would be excavated and transported to an approved hazardous waste landfill for disposal. This alternative would generally meet Site remediation goals, although there are issues regarding proper treatment at the landfill facility. Additionally, the alternative is very expensive, totaling S1,365,000.

GROUNDWATER (All include IAPTS operation)

GW1 No Action

Since there is currently a 5-well groundwater system currently in operation, this alternative will consist of operation of this system only, with no other actions taken. While the system will capture and treat affected groundwater, the time required to cleanse the aquifer may be very long, because chemical concentrations (and hence effectiveness) tend to drop off over time.

GW2 Groundwater Use Restrictions & Monitoring

Under this alternative, institutional controls such as deed restrictions are used to restrict usage of groundwater in the affected area. Regular monitoring and assessment of groundwater movement and quality would occur. Although exposure may be prevented, this alternative does not meet all of the Site remedial goals. Tow costs would be $4,078,000.

GW3A,B Groundwater Extraction, Treatmcnt~ (A) Sprayfield or (B) Treatment Works Discharge

An expanded pump-and-treat system would be constructed and operated. While the length of treatment time may be reduced, long-term problems in reaching the groundwater remedial goals would likely still occur. Costs total (A) $6,683,000 or (B) $6,813,000.

GW4 Insitu Chemical Treatment

Liquid solutions containing a reducing agent are delivered to the subsurface and placed into contact with hexavalent chromium in groundwater. Technology has the potential to achieve a permanent reduction in the mobility, toxicity, and volume of contaminated groundwater. Site remedial goals would be met cost-effectively. Total costs would be $3,282,000.

candidates, S4 is superior to S3 based on long-term effectiveness and permanence, and superior to both based on reduction in toxicity, mobility or volume, and cost-effectiveness. Additionally, the FS concludes (and EPA agrees) that a cap (S2) may not meet all of the environmental requirements for a remedial action, and that excavation and offsite disposal (S5), in addition to its costliness, could generate public concerns or contamination at the landfill site, simply transferring the problem elsewhere.

For groundwater, Alternative GW4, Insitu Chemical Treatment, achieves the greatest degree of reduction in toxicity, mobility and volume of the primary groundwater contaminant, hexavalent chromium. The technology is considered "innovative" by EPA, which means that it has been applied at a limited number of sites, and lacks the extensive cost and performance data that would predict certain success at this Site. However, it has the potential to achieve a long-term, permanent removal of hexavalent chromium from the affected groundwater, and can do so in a cost-effective manner. Groundwater treatment can be completed in a much shorter length of time than with the pump-and-treat alternatives (GW3A and 3B), based on EPA and environmental industry experience to date with pump-and-treat. As with Alternative S4, Alternative GW4 is more cost effective in achieving remediation goals than the other choices.

Description of the Remedy. The remedy consists of insitu chemical treatment of both soil and groundwater, described in the FS as Alternatives S4 (soil) and GW4 (groundwater). As described in the FS, alternative GW4 (and thus the remedy) includes continued operation of the Interim Action Pump-and-Treat System. EPA's selected remedy includes four remedy components, which are described below. The descriptions are based on the recently-completed Feasibility Study.

Soil Treatment (Source Control)

Insitu chemical treatment, and specifically, insitu chromium reduction, is a fairly new, innovative technology in which a liquid solution containing a reducing agent is placed on, and percolated into, chromium-bearing soils. Upon contact with the reducing agent, hexavalent chromium in the soils are reduced to an insoluble, non-toxic, more stable chemical state. The treatment will be accomplished insitu, that is, with no excavation required; reagent may be simply percolated into the soil. This technology is particularly applicable to sites with shallow soil impacts (<2 feet deep) such as the Townsend Saw Chain Site.

To implement insitu chemical treatment, first, surficial soils and sludges (up to 6 inches) within the former wastewater pond area will be removed and disposed of offsite. This will remove the most highly affected soils and break up the crusty top layer, improving contact of the treatment solution with the chromium-impacted material. Introduction of the solution may be accomplished by one of any number of means, including injection or use of surface application equipment, such as that in use at the onsite sprayfields. The treatment solution percolates through impacted soils and reduces the hexavalent chromium. Soil sampling will be undertaken to verify the effectiveness and permanence of the reduction/immobilization effects. Targeted or repeated applications may be required to achieve the remediation goals.

Pilot-scale treatability testing was conducted at the Site during late April - early May 1995, as reported in the treatability study report entitled "Demonstration Study: In-situ Chromium Reduction in Soil and Groundwater, Homelite - Textron" (at the information repository; see page 14). The EPA National Risk Management Research Laboratory in Cincinnati, Ohio assisted in EPA's review of this work. The Demonstration Study was not intended to determine all of the delivery methodologies, operating parameters,

and testing programs needed for full-scale implementation, but rather to demonstrate, in onsite field trials, the basic chemical effect. Reduction of hexavalent chromium concentrations was demonstrated in both soil and groundwater.

Insitu chemical treatment activities would be expected to occur over a period of approximately one year, and for planning purposes, it is assumed that periodic soil sampling will be conducted for five years. Reduction of hexavalent chromium to concentrations below levels of concern is likely to occur rapidly. Additional treatability work will likely be needed to determine design parameters before full-scale remediation. If needed, installation of insitu chemical injection equipment should be implementable at the Site without major technical or administrative difficulties. Dust control measures and personal protective equipment will be required during the first stage of remedial activities, excavation of the top 6 inches of soil, to prevent short-term exposures of the community and Site workers to contaminants.

Insitu chemical treatment of soils will cost about $769,000 in capital costs and $88,000 over five years for operations and maintenance (O&M) costs, for a total cost of $857,000.

Groundwater Remediation

The groundwater remediation component of the remedy includes 1) Insitu Chemical Treatment of groundwater and 2) continued operation of the IAPTS to capture and treat affected groundwater. As described above, Insitu Chemical Treatment is a new, innovative technology which uses liquid solutions containing a reducing agent. To remediate groundwater, the solutions are delivered into the saturated zone (into the aquifer) to allow and foster contact between contaminated groundwater and the reductant solution. Upon contact, the hexavalent chromium in the affected groundwater is reduced, and precipitates, forming an inert, insoluble, non-toxic mineral containing

chromium in its more stable (trivalent) chemical state.

Insitu chemical treatment activities are expected to require a period of approximately one to two years. Reduction of hexavalent chromium to levels below the remediation goal is expected to occur rapidly; however, a phased approach to remediation would likely be undertaken. In conjunction with the existing IAPTS, this alternative would provide a contained "treatment area" for groundwater, within which an evaluation of the reduction/immobilization effects can be completed. Insitu chemical treatment performance will depend in large measure on maintaining peak operating conditions and careful maintenance of the delivery systems used to place the reductant solutions into contact with groundwater. Specially-targeted or repeated applications may be required to achieve the remediation goals. Even using a phased approach insitu chemical treatment is expected to be conducted over a short time (one to two years), with minimal maintenance of treatment equipment required. Regular monitoring of the affected groundwater will be required throughout the remediation process.

Chemical treatment conducted ex-situ (i.e. in treatment vessels) is a commonly-used technology for treating groundwater affected by heavy metals, and is the technology currently in use for treating groundwater at the Site. As an insitu treatment, however, the technology is still being tested and evaluated at a few sites around the United States. As is noted above under the soil remedy description, pilot-scale treatability testing conducted at the Site during 1995 ("Demonstration Study: In-situ Chromium Reduction in Soil and Groundwater, Homelite - Textron") showed that the basic chemical effect, reduction of hexavalent chromium concentrations in groundwater, was occurring. Additional work will be needed to determine design parameters before full-scale remediation can be completed.

Development and use of the insitu approach in groundwater will require a remedial design phase consisting of a planned, phased approach, which addresses 1) delivery strategies, 2) a strategy for verifying non-reversibility of the chemical effect, and 3) a plan for evaluating how well the insitu reduction process is working)"how to measure success"). Even with careful planning, use of this innovative process will involve a large degree of trial fieldwork and evaluation of effects.

Appropriate equipment is expected to be available as needed, and installation of it is unlikely to involve any difficulties. Delivery options may include, alone or in combination, use of the current sprayfield equipment multiple well points, or other simple technologies capable of delivering the solutions to the affected groundwater.

During the treatment period, the IAPTS will remain operational and the remediation goals for all of the groundwater chemicals of concern will be pursued. However, following insitu chemical treatment, if hexavalent chromium levels throughout the plume are successfully and substantially reduced to levels below the groundwater remediation goal (0.1 mg/l) through the insitu chromium, reduction treatment, EPA may then elect to reevaluate the need for continued groundwater extraction and/or groundwater treatment to address other COCs, as necessary, depending on the concentrations still present in the aquifer. This could require EPA to modify the Site remedy in order to consider the need for and effectiveness of continued pumping, and to allow consideration of other options, such as reduced or targeted pumping targeted use of any new or innovative technologies as may become available, modelling or evaluation of natural degradation processes, or others.

Initial-investment (capital) costs for Insitu Chemical Treatment of groundwater will total approximately $2,624,000 over the first year (includes the cost of IAPTS construction), plus

five years of O&M costs totaling $658,000, for a complete groundwater remediation cost of $3,282,000.

Site Monitoring

A Site Monitoring Plan will be developed during the remedial design phase. As a minimum, site monitoring will include the quarterly sampling presently conducted under the IAPTS operation (and the current industrial wastewater permit from SCDHEC). The present sampling scheme consists of sampling and analysis from fifteen monitor wells, two extraction wells, and surface water at the spring/seep which feeds the unnamed offsite tributary. Although not described in the FS, monitoring will also include periodic sampling of surface water for chromium at a minimum of one (1) downstream station on the tributary, in the same manner as presently done for the seep water sample. The exact location of this station will be determined during remedial design, but will be at, or upstream of, the confluence of the tributary and Spears Creek. The purpose of this sample is to evaluate surface water quality.

Seep Area Sediment Removal (Remedial Action for Ecosystem Protection)

As described in the FS (Appendix G), a small-scale removal action will be conducted to remove an area of sediment which contains significantly elevated levels of chromium. In a simple and direct manner, this action will eliminate any potential harm or effects to tributary plants and animals. The estimated volume of affected sediment is between 30 and 85 cubic yards. The action will be undertaken once EPA is satisfied that the groundwater capture effect imposed by the IAPTS is sufficient to prevent sediment re-contamination once the action is completed.

Total cost of the remedy. The approximate total present worth cost of the selected remedy is

$4,139,000. Total capital costs are $3,393,000 and total O&M costs are $746,000.

WHAT COMES NEXT?

EPA is seeking public comments and input concerning the Alternatives EPA has selected as its preferred alternative. At the public meeting to be held on September 17, 1996, EPA officials will describe the cleanup plan, the strengths and weaknesses of the other cleanup alternatives, and EPA's reasons for selecting these particular soil and groundwater remedial alternatives. Public questions and comments will be welcomed, and will be addressed at this meeting. A 30-day public comment period is being held from September 6, 1996 to October 7, 1996 to provide all citizens an opportunity to contact EPA or SCDHEC concerning the Site and EPA's Proposed Plan.

After reviewing public comments, questions and concerns from the public meeting, and from written and verbal comments received, EPA will publish a Record of Decision (ROD) documenting its selection of a cleanup plan. All comments received will be discussed and considered in the ROD. EPA anticipates ROD issuance in October or November 1996.

Please refer to page 14 of this publication for more information on how to contact the EPA and SCDHEC staff working on this Site, and where more Site-specific documents and information can be reviewed.

SITE BACKGROUND

The Townsend Saw Chain Company Site is a small manufacturing facility located at the intersection of Interstate Highway 20 and State Highway 53 (Spears Creek Church Road) in Pontiac, Richland County, South Carolina.

The facility was owned by Textron, Inc., between 1971 and September 1994 and is presently owned by Deere and Company (John Deere). (Textron remains

responsible to EPA and SCDHEC for the ongoing environmental cleanup work.) The plant property, approximately 50 acres in size, is surrounded by a barbed-wire fence. The facility has been in operation since 1972 and is used for the manufacture of saw chains and chain saw bars. Prior to 1972, between 1964 and 1970, Dictaphone Corporation manufactured specialized office recording equipment at the facility.

Between 1966 and 1981, under both Dictaphone and Textron, waste rinsewaters produced during metals-plating and other processes were disposed of by direct discharge to the ground surface in the low-lying "waste pond" areas adjacent to the facility on the north side. This discharge is the origin of the onsite groundwater contamination. In 1982 the South Carolina Department of Health and Environmental Control (SCDHEC) investigated the Site. Investigations since 1982 have confirmed the presence of groundwater contaminated by chromium and nitrate onsite and offsite, as well as trace groundwater concentrations of volatile organic compounds.

Since 1982, SCDHEC has continued to oversee Textron's investigation and cleanup program for groundwater. In 1982, a groundwater treatment system was installed, consisting of five extraction (pumping) wells, chemical treatment tanks, and a spray or irrigation field for disposal of the treated water. The system currently in operation uses a similar, though more advanced, electrochemical treatment system. Groundwater is extracted, chemically treated to acceptable standards, and then discharged to the spray field. Performance of the system and conditions at the spray field are monitored by SCDHEC. In 1987, SCDHEC identified problems in the treatment system's design and performance. To address those deficiencies, a subsequent 1988 modification to the 1982 Court Order directed Textron to further investigate and define the extent of groundwater contamination, and to investigate Site hydrogeology as necessary to modify the system's design. A report with design revisions was submitted to SCDHEC in 1990, and following SCDHEC review, again in December 1991. A modified permit for the system was issued by SCDHEC in December 1993. The system redesign effort was conducted in conjunction with the Interim Remedial Action design phase. The work was completed in December 1995, and operation of the expanded pump-and-treat system began at that time.

Between 1985 and 1988, SCDHEC and EPA took the necessary steps to list the Site on the National Priorities List (NPL), which places it in the Superfund program. During this period, investigations by SCDHEC revealed above-background concentrations of lead, cadmium, arsenic, cyanide, nickel, and four VOCs in groundwater at the Site. Chromium, lead, cadmium and arsenic were present above background levels in sediments within the waste pond area, and a stream water sample taken just across Spears Creek Church Road north of the Site contained chromium and four VOCs. Based on these results, the Site was then ranked by EPA in 1987 using the Hazard Ranking System (HRS), which evaluates the potential for public exposure to Site contamination. Because of the potential for migration of groundwater contaminants offsite, and the large number of people in the surrounding area served by water wells, the Site was assigned a high HRS score and was proposed for listing on the NPL in June 1988. The Site was finalized on the NPL in February 1990.

EPA and Textron signed an agreement in October 1991 under which Textron committed to conduct a Remedial Investigation/Feasibility Study (RI/FS). Dictaphone Corporation was named as a PRP by EPA when the Agency notified both Textron and Dictaphone that an RI/FS was required for the Site. Textron has voluntarily undertaken all Superfund investigation and cleanup activities to date.

RI field work began in early May 1992. The initial (Phase I) work was followed by further investigation of Site groundwater and soils (Phase II). Combined Phase I and II activities included the installation and addition of 15 new monitoring wells to the previous monitor well network. In total, the RI sampling included collection and laboratory analysis of approximately 200 samples of Site groundwater, surface and subsurface soils, stream (surface) water, sediment, and air. Between January and July 1993, at the end of Phase II work, three rounds of offsite shallow groundwater sampling were performed. These 49 offsite groundwater samples suggested that the plume of contaminated groundwater was moving offsite, continuing to enlarge, and potentially threatening downgradient water well users. After discussions with SCDHEC and Textron in July 1993, EPA decided to move forward with an Interim Remedial Action at the Site. A public meeting was held

in late August 1993, at Pontiac Elementary School, to discuss the proposed Interim Action and solicit public comment. An Interim Record of Decision (ROD) requiring Textron to take actions to prevent the continued offsite northeastward migration of contaminated groundwater was issued in by EPA December 1993. EPA then issued a Unilateral Administrative Order (UAO) for implementing the Interim Remedial Action (the "Interim Action") to Textron in May 1994. Textron voluntarily agreed to do all of the work outlined in the UAO requirements.

During the summer of 1994 Textron retained SECOR International, Inc., to perform the environmental activities comprising the Interim Action. The first step of the work involved a focused hydrogeologic study in the area northeast of Spears Creek Church Road (the offsite area). After SECOR's work plans for the hydrogeologic study and the Interim Remedial Action were approved by EPA, field work began in August 1994 and was completed in November 1994. A report summarizing the study findings, and serving as a general basis for planning the offsite pump-and-treat system (the "IAPTS") was submitted to EPA in January 1995. (The document, "Results of the Offsite Hydrogeologic Study," is among those placed at the information repository.)

During June to December 1995, the Interim Action pump-and-treat system was constructed and new treatment equipment connected to the wastewater treatment system. Full operations of the groundwater pump-and-treat system began in December 1995. Preliminary data indicate that the system is capturing affected groundwater in the offsite area.

Following revision of the draft, a final Feasibility Study for the Site has been completed and submitted to EPA. The FS was summarized in a recent fact sheet (July, 1996). EPA is currently requesting public input on its selected remedy for the Site. On September 17, 1996, EPA will hold a public meeting to announce its selection of a remedial alternative (cleanup plan) for the full and final cleanup of the Site. Please see page 14 for information concerning where to get more information, and on how and where to send your comments.

PUBLIC AND COMMUNITY REVIEW AND COMMENT

Written or verbal comments on this Proposed Plan, the Feasibility Study or any other issues related to Site cleanup are welcomed, and are an important part of our decision-making process. The public comment period begins on September 6, 1996 and ends on October 7, 1996. All written comments must be postmark no later than October 7, 1996. Please send your comments to, or call:

Ralph 0. Howard, Jr., Remedial Project Manager
U.S. EPA Region IV, North Superfund Remedial Branch
100 Alabama Street, S.W., Atlanta, GA 30303
Toll-Free (800) 435-9233

We trust that the 30 day comment period will provide adequate time for public input; however, the comment period can be extended for an additional 30-day period, should the need arise. Additionally, EPA and SCDHEC are available to meet with interested citizens and local officials to go over the proposed plan in greater detail and to address any community concerns should they exists. For more information on community involvement in the Superfund process, or at this Site, additional information, or matters pertaining to the comment period, please contact:

Cynthia Peurifoy, Community Involvement Coordinator
U.S. EPA Region IV, North Superfund Remedial Branch
100 Alabama Street, S.W., Atlanta, GA 30303
Toll-Free (800) 435-9233

The Project Manager for the South Carolina Department of Health and Environmental Control can also be contacted about this Site:

Yanqing Mo, Site Project Manager
S.C.D.H.E.C., Bureau of Solid and Hazardous Waste Management
Division of Hydrogeology
2600 Bull Street, Columbia, SC 29201
(803) 896-4030

INFORMATION REPOSITORY LOCATION:

Richland County Public Library
7490 Park Lane Road
Columbia, South Carolina 29223
(803)736-6575

Information available for public review at this location includes background information on the Site and on Superfund, as well as the Administrative Record (AR) for the Site. The AR contains all of the documents EPA will use to select a final remedy for the Site. At present, it contains the RI/FS Work Plans, a variety

of correspondence about the Site, the Baseline Risk Assessment, and the final EPA-approved RI Report. In a few weeks the Final, approved Feasibility Study and other correspondence concerning the Site will be added as the RI/FS is completed. Citizens are encouraged to review this material at their convenience. The AR is also available for review at the EPA Records Center, at the EPA address listed above.

GLOSSARY OF TERMS

Administrative Record - A file which is maintained and contains all information used by the lead agency to make its decision on the selection of a response action under CERCLA. This file is required to be available for public review, and a copy is to be established at or near the Site, usually at the information repository. A duplicate file is maintained in a central location such as a regional EPA and/or state office.

Applicable or Relevant and Appropriate Requirements (ARARs)- Requirements which must be met by a particular response action under consideration, or by an alternative selected by EPA as a Site remedy.
"Applicable" requirements are those mandated under one or more Federal or State laws. "Relevant and Appropriate" requirements are those which, while not directly applicable to the action, chemical or location being considered, EPA judges to be appropriate for use in that particular case.

Aquifer - A geologic unit or formation capable of producing a large enough quantity of water to serve as a source of drinking water, typically through wells or springs.

Baseline Risk Assessment - A statistical study in which the amount of damage a Superfund Site could cause to human health and the environment is assessed. Objectives of a risk assessment are to: help determine whether there is a need for action; help determine the levels of chemicals that can remain on the Site and still protect health and the environment; and provide a basis for comparing different cleanup methods.

Carcinogen - Any chemical or substance which is known, or suspected, to cause cancer in humans.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - A Federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. The Acts created a special tax that goes into a Trust Fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste Sites. Under the program, EPA can either:

1) Pay for Site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work,

2) Take legal action to force parties responsible for Site contamination to clean up the Site or pay back the Federal government for the cost of the cleanup.

Chromium (Cr) - A lustrous, hard, steel-gray metallic element commonly found in the earth's crust.
Chromium is used in the production of stainless steel and for hardening other metals. Chromium solutions are widely used in electrolytic plating operations to provide a hard, durable coating for metal parts.

Chromium occurs in two chemical forms, hexavalent (often abbreviated "Cr6+") and trivalent ("Cr3+").
The hexavalent form is more toxic, more mobile in groundwater, and is the form of Cr which is the cause

of concern at most hazardous waste sites (including this Site).

Ecological Assessment - A scientific study conducted for the purpose of identifying, and/or evaluating, ecological and biological damage to plants and animals in a particular area or habitat. An ecological assessment often includes chemical testing of laboratory test organisms to identify toxic effects, as well as an examination ("bioassessment") of native plants and animals in the area of interest.

Feasibility Study (FS) - See Remedial Investigation/Feasibility Study.

Groundwater - Water found beneath the earth's surface that fills pores within sand, silt, clay, soil, or gravel. In aquifers, groundwater occurs in sufficient quantities to be used for drinking water, irrigation and other purposes.

Hazard Ranking System (HRS) - A scoring system used by EPA and the state to evaluate relative risks to public health and the environment from releases or threatened releases of hazardous substances. An HRS score is calculated based on actual or potential release of hazardous substances through the air, soils, surface water or groundwater. This score is a primary factor used to decide if a hazardous waste Site should be placed on the National Priorities List.

Information Repository - A file containing current information, technical reports, and reference documents regarding a Superfund Site. The information repository is usually located in a public building that is convenient for local residents -- such as a public school, city hall, or library.

Innovative Technology - A term referring to new, little-known treatment methods or technologies which take advantage of recent scientific theories, developments or experiments. Typically, these technologies lack the extensive cost or performance data that would allow routine use at Superfund sites. However, innovative technologies have the potential to deliver significantly improved performance and cost-effectiveness.

Insitu - This term describes treatments or processes which take place within the medium which is affected, or within the medium to be treated. An insitu treatment involves no excavation, extraction or removal of the material to be treated.

Interim Remedial Action - A remedial action that is intended to address immediate potential threats which could become worse unless action is taken immediately. An interim action is not an emergency action; any situation that is an immediate threat to the public health and safety is addressed by EPA or the State as an "emergency response action." Such actions usually include removal of hazardous wastes and/or contaminated soil; thus they are referred to as "removals".

Maximum Contaminant Level (MCL) - Under the regulations which implement the Safe Drinking Water Act (SDWA), the MCL is the maximum allowable concentration of a contaminant in water delivered to any user of a public water supply well or water supply system. MCLs are based on human health and toxicological studies.

Mg/kg, mg/l - The term mg/kg, or milligrams per kilogram, is a unit defining the amount (by weight) of one substance within a fixed weight of another. One milligram is 1/1000 of a gram; one gram weighs about the same as a postage stamp, or about 1/28 of an ounce. A kilogram equals 2.2 pounds. The term mg/l defines how many milligrams of a substance are present (usually dissolved) within a liter of liquid. One liter is slightly more than one quart.

Monitoring Wells - Specially constructed water wells installed at specific locations on or near hazardous waste Sites. Groundwater samples for laboratory analysis, and water table measurements, are taken from such wells. Monitoring wells thus provide valuable data concerning the direction of groundwater flow and the types and amounts of contaminants present.

National Priorities List (NPL) - EPA's list of the most serious uncontrolled or abandoned hazardous waste Sites identified for possible long-term remedial response using money from the Trust Fund. The fist is based primarily on the score a Site receives on the Hazard Ranking System.

Nitrate (NO 3) - A nitrogen compound consisting of, or containing, the radical N0 3. As a groundwater contaminant, nitrates can result from agricultural use of fertilizers, or as wastewater from manufacturing processes using compounds containing nitrates.

Offsite - The terms "offsite" and onsite are used in this Fact Sheet to distinguish the Site property, bounded by I-20 and Spears Creek Church Road (SC Road 53), from the offsite areas across Spears Creek Church Road. However, under CERCLA, the "Site" includes those adjacent areas affected by contamination originating from the Site.

Plume - A three-dimensional zone within the groundwater, i.e. having length, width and depth, which contains contaminants and generally moves in the direction of, and with, groundwater flow.

Potentially Responsible Parties (PRPs) - Any individual(s) or company(s) (such as owners, operators, transporters, or generators) potentially responsible for, or contributing to, the contamination problems at a Superfund Site. Whenever possible, EPA compels PRPs, through administrative and legal actions, to clean up hazardous waste Sites which they are responsible for.

Pump-and-Treat System - An active groundwater treatment system which extracts contaminated groundwater from the subsurface by a network of extraction wells, and removes the contaminants from the groundwater by various proven technologies.

RCRA, the Resource Conservation and Recovery Act - A 1976 Federal law which established a regulatory system for tracking hazardous wastes, from the point of generation through disposal. The law requires that safe and secure procedures be used in transportation, treatment, storage, and disposal of hazardous substances. RCRA is also designed to prevent the creation of abandoned uncontrolled hazardous waste sites. Subtitle C is the portion of RCRA which regulates hazardous waste landfills, while Subtitle D concerns non-hazardous waste landfills.

Record of Decision (ROD) - A public document which explains how EPA reached a decision to select a cleanup alternative to be used at a National Priorities List Site. The ROD is based on information and technical analyses generated during the remedial investigation/feasibility study and upon consideration of public comments and community concerns.

Remedial Investigation/Feasibility Study (RI/FS) - Two distinct but related studies, usually performed concurrently, and together referred to as the "RI/FS". They are intended to gather the data necessary to determine the type and extent of contamination at a Superfund Site; establish criteria for cleaning up the Site; identify and screen cleanup alternatives for remedial action; and analyze in detail the possible technologies that could be employed and the costs of the alternatives.

Superfund - The common name used for the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (see also "CERCLA" above), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

Volatile Organic Compound (VOC) - An organic (carbon-containing) compound that evaporates (volatilizes) readily at room temperature. Also called "solvents," VOCs such as trichloroethylene (TCE) and tetrachloroethylene (also called perchloroethylene, or PCE) are common industrial contaminants at environmental sites.

REQUEST TO BE PLACED ON THE
TOWNSEND SAW CHAIN COMPANY SUPERFUND SITE MAILING LIST

If you would like your name and address placed on the mailing list for the Townsend Saw Chain Company
Superfund Site, please complete this form and return to: Cynthia Peurifoy, Community Relations Coordinator, EPA-Region IV, North Superfund Remedial Branch, 345 Courtland Street, Atlanta, Georgia
30365, or call 1-800-435-9233.

NAME:

ADDRESS:

TELEPHONE:

AFFILIATION:

Attachment B
Public Notice of Public Comment Period

<IMG SRC 97019O>

Attachment C

Letter (Public Comment) Concerning the Proposed Plan

SECOR
International Incorporated

October 7, 1996

Mr. Ralph Howard
Remedial Project Manager
USEPA, Region IV-WD-NSRB-SC

100 Alabama Street, SW
Atlanta, Georgia 30303

Re: Chromium Surface Water Remediation Goal for the Offsite Tributary
Townsend Saw Chain Site, Pontiac, South Carolina

Dear Mr. Howard:

SECOR International Incorporated (SECOR) representing Textron, Inc. (Textron) has prepared this letter is to provide comment on the surface water remediation goal for total chromium in the offsite tributary (OST) of Spears Creek at the Townsend Saw Chain Site, Pontiac, South Carolina (Site). In the Feasibility Study for the Townsend Saw Chain Site, Pontiac, South Carolina, dated August 19, 1996 (SECOR, 1996), a total chromium concentration of 11 μg/L, based on the National Ambient Water Quality Criteria for the Protection of Aquatic Life (AWQC) (USEPA, 1985), has been presented.

Chromium Surface Water Remediation Goal

It is the position of Textron that the use of the AWQC of 11 μg/L for total chromium is overly conservative and ignores site-specific information that was collected under the oversight of the United States Environmental Protection Agency - Region IV (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). This statement is supported by several factors:

- The AWQC does not represent site-specific conditions. A site-specific ecological assessment, which quantified the potential impact on the OST by the presence of hexavalent chromium in surface water, was performed by Shealy Environmental Services as part of the Remedial Investigation activities (Aquaterra, 1994). Using the value of 11 μg/L does not account for this site-specific assessment.

- The AWQC of 11 μg/L is based on potential effects due to hexavalent chromium (USEPA, 1985), not a total chromium concentration.

- In environmental conditions, the most significant form of chromium is the trivalent form. Hexavalent chromium, in most natural water, is frequently not present or only found at very low concentrations. In many streams there is enough organic matter in the water and the redox and/or pH is such that any hexavalent chromium would be rapidly reduced to the much less toxic trivalent chromium. The AWQC for trivalent chromium is 210 μg/L (Suter and Mabrey, 1994).

Ambient Water Quality Criteria

The AWQC for hexavalent chromium of 11 µg/L is based on non-site-specific studies. Based on the results of the site-specific toxicity testing performed by Aquaterra, no adverse impacts to the test species were seen at 11 µg/L of total chromium (not until 49 µg/L were the site-specific test species affected). Therefore, the AWQC is likely over-protective of aquatic species in the OST. Further, the AWQC have not been revised since 1985, so they do not incorporate any recent scientific findings from USEPA or other researchers.

Summary

Textron disagrees with the use of 11 µg/L as the total chromium surface water remediation goal. Based on the information presented above, we reserve the right to identify the final remediation goal after completion of the proposed groundwater remediation activities. As presented in the Feasibility Study, both the Interim Action Pump and Treat System (IAPTS) and the proposed remedial activities are designed to prevent further migration of chromium in groundwater into the OST (SECOR, 1996). Based on surface water analytical data collected in the past two years, the total and hexavalent chromium concentrations have decreased. This decrease in concentration is likely due to past and ongoing remediation activities (e.g., pumping and treating groundwater). This trend of decreasing concentrations is likely to continue as a result of the one year that the IAPTS has been in operation and the future operation of the proposed remediation system.

Once the groundwater remediation activities as described in the Feasibility Study have been completed, additional discussion should occur regarding a surface water remediation level, considering site-specific factors and any additional scientific findings regarding the toxicity of chromium in aquatic environments.
The analysts who conducted the ecological assessment (i.e., Aquaterra and Shealy) recommended performing no active remediation of the surface water and sediment in the OST, as the impacts are only slight to moderate and the treatment of the onsite groundwater (via the IAPTS and other remediation activities) will likely result in the mitigation of the chromium in the OST (Aquaterra, 1994). SECOR and Textron concur.

References Cited

Aquaterra Engineering, Inc. 1994. Technical Memorandum of Ecological Assessment, Townsend Saw Chain Site, Pontiac, South Carolina. May 6.

SECOR International Incorporated (SECOR). 1996. Feasibility Study, Townsend Saw Chain Site, Pontiac, South Carolina. August.

Suter, G. W. And J.B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. National Laboratory, Oak Ridge, Tennessee.

United States Environmental Protection Agency (USEPA). 1995. Ambient Water Quality Criteria for Chromium - 1984. EPA 440/5-84-029.

Your questions or comments are welcomed. Please contact Carol Maslanka (916-648-9160) or Mike Bedan (303-545-2017) with questions, comments, or requests for additional information.

Sincerely,

SECOR International, Inc.

<IMG SRC 97019P>

MEB/mb

cc: Gerald Benson, CEE
Robert Brayley, Textron
Jamison Schiff, Esq., Textron
Jim Plunkett, SECOR

Attachment D

Proposed Plan Public Meeting Sign In Sheets

<IMG SRC 97019Q>

Attachment E

Official Transcript of the Proposed Plan Public Meeting

PUBLIC HEARING

UNITED STATES EPA

SUPERFUND PROPOSED PLAN
TOWNSEND SAW CHAIN SUPERFUND SITE
PONTIAC, SOUTH CAROLINA

* * * * * * * *

ORIGINAL

Tuesday, September 17, 1996

7:35 p.m. to 8:01 p.m.

CREEL COURT REPORTING, INC.
1720 Main Street, Suite 202 / Columbia, SC 29201
(803) 252-3445 / (800) 822-0896

MR. HOWARD: Good evening, my name is Ralph Howard, I'm the EPA project manager for the Townsend Saw Chain Superfund Site and our purpose tonight is to discuss the site and specifically EPA's proposed plan for cleaning up this site for a final cleanup at the

Townsend site. These are the items I'd like to cover, and you'll notice at the end of the evening we've reserved some time for question and answer and some comments, public comments, hopefully we'll have some public arriving here, about the proposed plan and any question you may have about the site, we'd like to answer it at that time. Again, my name is Ralph Howard, I'm EPA's project manager for the site, and a good way to start is to introduce the other state and federal officials here. From EPA also, Ms. Cynthia Perifoy seated here to my right. Cynthia is the community relations coordinator for EPA on the site and she is concerned about your input and feelings about what EPA is doing here. From the South Carolina Department of Health and Environmental Control, DHEC, we have a number of individuals present: Ms. Yanqing Mo is here somewhere, she is the state project manager. Her supervisor is Mr. Kemp Coleman who is with the Department of Geology at DHEC. Also Mr. Gary Stewart is here, and Mr. Tom Knight, those gentlemen are from

DHEC. Representing Textron is Mr. Jerry Benson, and representing SECOR, who is the consultant for Textron, is Mr. Tim Holbrook. To begin with, I should mention about Superfund, what is Superfund and what is EPA doing here. Superfund is a law passed by Congress in 1980, Comprehensive Environmental Response, Compensation and Liability Act, or CERCLA is the abbreviation, better known as Superfund, was reauthorized by Congress in 1986 with a series of amendments, and that's the federal law that is of interest here tonight. A number of steps are involved in Superfund. I've highlighted the two that are about to occur, actually I could have highlighted step number five of the proposed plan, which we are going to discuss tonight. And again, this is specifically a plan for final cleanup, long-term cleanup action at the site. When a site is discovered and evaluated by EPA, if the site conditions warrant, the site is listed on the actual priorities list with the EPA, two things then happen, a ... well, it's published in the federal records, but, more importantly, studies are done to determine how bad the site is and what should be done to clean it up. Remedial investigation is a study in which the contamination and its extent are determined and a risk assessment is also done to try to evaluate both qualitatively and quantitatively the risks posed by the site to the human element environment if the site is not addressed. Following that, a feasibility study is done, and which was actually recently completed at this site, in which all the potential ways to clean up the site are considered and alternatives are put together that utilize these methods of cleanup. These alternatives are then evaluated one against the other and at the end of the feasibility study, EPA will then select the alternative that is best suited to clean up of the site. Under Superfund, EPA can elect to clean up the site itself if no responsible parties can be found, or private parties may be ... agreements are reached under which those parties perform the cleanup, and in this case Textron, Incorporated, is the responsible party at the site. You will notice that community relations is shown as occurring throughout the process and that is indeed the case, we'd like to hear from you tonight, and to pursue that topic further, I'd like to ask Cynthia to have a word or two about community relations.

MS. PERIFOY: Good evening. Again, I'm Cynthia Perifoy, and I'm community relations coordinator for EPA for this site and the sites, EPL sites in South Carolina. I want to go over a few ... a few items of interest which are appearing on the slide. Our public comment period ends October 7th, it doesn't end tonight, we will take comments that you might have throughout this period as it states in the fact sheet, that can be extended if need be for an additional 30 days. We do have an administrative record available at the Richland County Library on Parklane Road, that record is also available at the EPA offices in Atlanta, even though we just moved, we probably can't find them, but they are available for your review. I want to make it known that the site is still available for the technical assistance grant. It will be available up until the site goes into a remedial action, I believe. So that is a grant that is available to communities for the hiring of a technical advisor to go over the EPA documents with you and to provide comments and some explanations to community members. If there is anyone that's interested in pursuing that, I will be glad to work with them on that. Of course, we always appreciate your feedback on our activities. We do have an 800 number, which is 1-800-435-9233, it did not change. Call us and let us know other things that we can do that might be helpful. I want to take a little time to set the stage for tonight's meeting. As you can tell, we have a court reporter here, we are having

a transcript done of this meeting for the record; we ask you to identify yourself when you speak and make sure that our court reporter can hear you. It's very important that she hears everything and gets down everything. She'll probably be giving us little signals when she can't hear you, so please pay attention to her, and I thank you.

MR. HOWARD: I neglected to mention two other attendees that I should have who represent DHEC. Dr. Rose Litchett is with us tonight, and Mr. Eric Melaro, they are both with DHEC and they're with the area that has to do with health/hazard evaluation. At the Townsend site, despite the process I showed you earlier, there has been some slight difference in what all activities that have been conducted since 1994. On the top line here you can see the rather standard remedial investigation and feasibility study process which has continued throughout this time. In late 1993, EPA and the responsible party elected to break off from that process and do what's called an Interim Remedial Action which allowed us to proceed in a faster manner towards groundwater cleanup. As I'll get to in a moment, groundwater contamination has always been a main concern at the Townsend site and this was a means to move on that concern in a quicker manner. That's the

middle track on this slide. Those activities are, for the most part, completed as of December of this past year when a ground work pump and treat system was constructed and actually checked out and operation began. That was in December '95. The lower item on the slide refers to a preexisting DHEC requirement. EPA began activities on the site in 1992. The Interim Remedial Action essentially incorporated that requirement resulting in an upgrade of the pump and treat system. There is now a five well pump and treat system operating on the site that has achieved control of the groundwater problem that I'll be further discussing. As you see across the top line, a number of activities have continued. The ecological work was actually completed following all the remedial investigation work. During 1995 a number of Feasibility Study activities were pursued immediate to August of 1996, as you see on the right. These are the items that occurred in the Interim Remedial Action. I wanted to illustrate the variety of activities that were undertaken during that time. There was a hydrogeologic study done to put a firm limit on where the groundwater contamination was. That was completed late in the year 1994. The groundwater pump and treat system was then designed and constructed in the latter

part of 1995. There was a short period to obtain a contractor. The system was inspected and operations began in December of 1995. To understand the Townsend site, the first item to be considered is the site history. The origin of the problem concerning groundwater is certain to have come from the first two bullets that you see here. Wastewater practices in the past being what they were, to process wastewater from plating and other operations went directly to the ground. There were, and still are, some low lying areas to the north of the plant, which is located just 500 feet to the south of us here from the school ground, and into those low lying areas went most of the process water from both the previous owner, Dictaphone Corporation, and then later Townsend Saw Chain company. The facility was used by the Townsend Company to make parts for chain saws. It was used by Dictaphone to make recording equipment. The potential for groundwater contamination was realized early on. Since 1982, there has been rather continual DHEC oversight. EPA became involved in 1985. Remedial actions were actually initiated in 1982 when DHEC issued an order requiring a pump and treat system be built. The company built the system that captured and treated groundwater and discharged that water to the spray

field areas surrounding the site, that's the open ground around the property. That effort began in 1982. EPA again became involved in 1985 after notification from the state and a site inspection was conducted. At that time, it was found that the groundwater contamination did extend beyond the plant to property across the northeast, across Spears Creek Church Road that this school is on, and that was of great concern. It was also found to be coming out from a seep or spring located northeast of the road. Steps were taken during those years, in the latter eighties, to get the site onto the National Priorities List. South Carolina DHEC did require some modifications and upgrade to the pump and treat system that was still operating in 1988.

That work continued on through final permit approval in 1993. And this was a conscious effort by EPA and DHEC to avoid duplicating work that was being done anyway, and that led to the pump and treat system that I described earlier being completed this past December. The site was listed eventually in 1990. There were some concerns at that time about the school. In 1995, as I mentioned, the pump and treat system came on line. You see the other activities leading to tonight. The best way to illustrate what's been found by the studies is to show you an aerial photograph of the area and

some of the conclusions that were drawn by the remedial investigation which concluded in late 1993. The scale of this photograph is a little bit hard to determine, but for reference, the exit that you see on I-20, which is down in the lower left here, from the upper to the lower exit ramps is about 750 feet. Our studies in the Remedial Investigation and in the Interim Remedial Action show that the groundwater contamination extends from the plant property, and I think I'll have to go point, but the plant is to the left of this slide, extending up to the right some 750 feet. I'll walk up there in a moment and point. There is also a tributary shown again up into the right from the plant. I'll walk over and point at those. Here's the plant, here's the tributary and the groundwater flowing is like so. This distance, 750 feet, the same as this. This line shows red for vegetation by the way, and the red can be interpreted as the more dense or vegetated land. But this does give an illustration of the scope of the problem and also the limited scope of that groundwater problem. Over to the extreme right of this slide, the dark blotch that you can see on the right most edge is, in fact, the Wood Creek Lake. There is a number of homeowners who have lake homes and they were concerned about their drinking water. Those wells have been

sampled three times since 1992 and have always been found to be completely clean and unaffected. The distance from that lake back to the limit of the groundwater flow is approximately one mile and this should be kept in mind. The two areas just to the north of the site you may notice are gray blotches. Those are, in fact, the low lying pond areas. This photograph was taken in 1989, no water had been discharged to that area for some seven years, but the length of time over which water was put there has obviously had an effect on the way the ground surface is, and so forth, and, those are the origin of the groundwater problem that show up quite clearly here. During the Remedial Investigation not only was the groundwater limit ... I'm sorry, the Remedial Investigation and the Interim Remedial Action, not only was the groundwater contamination limit established but we learned more about where our soil problem was on site. There isn't much of a soil problem at the site. The wastewater ponds or the pond areas that are gray in this photograph are themselves or do themselves contain a significant amount of chromium, although chromium is not a human health hazard, but the chromium is capable of influencing groundwater, and that's not too surprising given the number of years that water was

placed out onto those areas. We had two smaller areas of soil contamination that don't really show on a photograph of this scale, but they are very small and are being handled outside of the Feasibility Study, being handled under the Interim Remedial Action. That is an explanation of the landfill operation of a small amount of soil. Those had to do with the pipes that deliver water out onto the waste ponds. That was all soil contamination and I'll show you a map in a moment of exactly where that is. The little tributary I pointed out, sediment and surface water in this tributary are affected. Our Ecological Study was intended to determine whether or not the ecosystem problem was being caused. We also, of course, did a Risk Assessment that considered that, as to whether it was a human health problem, and I'll get to the Risk Assessment in a moment. That study was ... that Ecological Study was inconclusive in nailing down with certainty that ecological problems were being caused by site contamination. When I explained to the photograph people which area I was interested in, they left the yellow sticker right on the photograph and just took the picture. This diagram shows you the groundwater plume, as we call it, the three dimensional area in the shallow aquifer that has contamination. It's important

to note that our contamination is only in the shallowest aquifer, we do not have a deep contamination problem here. This is a recent map from approximately three or four months ago, the last quarterly sampling.

As part of the pump and treat system, there are quarterly samples collected. The darker areas obviously represent the high levels of contamination. To the west or to the left of this side, you can see that the plume is contained within the property boundary, and again to the right our distance off site is approximately 750 feet. The tributary shows as the dotted line at the top of this slide in the off site or northeast area. This shows our soil contamination on site. The highlighted areas have more than 10 milligrams per kilogram of hexavalent chromium which is the form of chromium that caused this problem at the Townsend site, both in groundwater and soil. The highlighted areas have more than 10 milligrams, as I mentioned; however, our cleanup standard is slightly higher than this. In determining a cleanup standard, a Feasibility Study, this is to give an idea of where the worst soil is, and again you see the relationship to the former waste ponds or the water ponds area. Also, the hard line, by the way, is the limit of the groundwater problem on this site property. As I

mentioned, a Risk Assessment was done in 1993 by a EPA contractor and it was updated in 1996. The update consists of an addendum to the Risk Assessment, which included the Feasibility Study, and that's available for your review at the locations Cynthia mentioned. Our overall conclusions from the Baseline Risk Assessment and from the Addendum were as shown here. Groundwater use is the one to be concerned with in the future, but it should be noted that you would have to have a drinking water well in the area that's affected, not simply in the off site area. You would then need to be exposed to that groundwater as your drinking water source for a number of years to ... I'm sorry, to counter any possible health effects over the long term. That could pose a risk under a future use scenario were a groundwater well be installed at that location. We do not have risk of surface water and sediment which should be of interest, if you are walking around in that area, you really do not need to fear anything as far as surface water and sediment from the EPL standpoint. And as I mentioned earlier, the soil itself does not pose a risk to workers or site trespassers or kids or anyone else. Before I mention the goals a little bit that are presented here, it should be noted that in view of the ecological ... the potential for ecological harm, EPA is requiring that the responsible parties agree to conduct a small scale sediment removal as a means toward ecological protection. What this will do is, it will remove sediment that even could cause ecological harm in the off site areas as we saw in the map across that road, across Spears Creek Church Road. That action would eliminate the potential for harm to creatures living in and along the tributary. We will only perform that action, however, after ... or the responsible party will perform that action after we are confident about the pump and treat system and its ability to prevent re-contamination of that sediment. We don't want to do this twice. So our goals overall, based on what I've just presented, are ... there's a good number of them here. We have groundwater, soil, sediment and surface water that are affected even though the problems associated with each is different. For soil, our real problem is to protect groundwater. For groundwater, there are a number of things, the obvious one is not to drink it, to prevent ingestion of it, but we also like to keep it out of surface water so that it does not cause, in turn, surface water problem. That problem would be ecological in nature, by the way, not human/health risk. We would also like to restore the groundwater as a potential water source for people in that area. For sediment, our problem is ecological and we do want to take out any unacceptable ecological risk out there. Ecological risks again are difficult to quantify but they have a way of going up the food chain and we would just like to prevent that entirely. And finally, for sediment, our problem is ecological in nature and we again want to protect the ecosystem, we don't want to re-contaminate after we do the sediment clean-up action. But as in Superfund and in most environmental work, we must determine how good is good enough and what are your standards going to be. These are based on a number of things, federal laws, the state laws. Regulations usually implement the laws, so regulations have a bearing, as does the extent of the contamination, as far as how bad is it and where does it go? We have to look at sensitive environments and you have to look at levels that will cause the problem versus those that can be left alone. In our case, a good bit of work went into the Feasibility Study to determine these levels. Most of the groundwater numbers represent federal standards that the state also adheres to. The surface water standard is a federal standard, and the surface soil number was determined, site specifically, based on what would leach or could

leach to groundwater. So the number on surface soil is intended to prevent the soil from causing a groundwater problem. In the Feasibility Study, the whole objective or the whole point of the study was to come up with alternatives, that is, different ways that one could go about cleaning up the site. All the technologies that you could use and all the methodologies you could use are looked at and assembled into alternatives. An alternative is a grouping of these methodologies or technologies that you will use to clean up the site. We always consider a no-action alternative to better illustrate what will happen if nothing is done. You may recognize this from the fact sheet and this is simplifying it from there. If we don't take action here to address soil, the most likely result is that any soil that is affecting groundwater will continue to do so. No action will be taken to actually clean up the site or change anything about the soil, it will be left as is. EPA does require a five year report and there will be some status reporting to be done. That will be the only costs. Another option would be to simply cover the entire site with a cap to try to prevent, in this case, prevent infiltration which could take the chromium down into groundwater. It would not be a human health problem here, although a cap would

prevent anyone for actually touching that soil and messing around with it. You could also, by chemical means, actually turn the entire soil area, and our problem is shallow surface soil, by the way, you could turn the entire thing into a model or block that itself would not leach to groundwater. This can be expensive. It would work but there are some questions about it as to its long-term effectiveness. There is also a new methodology out there that EPA considers emerging, and that is, it's not in routine use and it has no large database or performance or cost data. However, the methodology has promise and essentially what happens is that the water solutions which contain a producing agent actually cause a chemical change in the soil which locks the soil up by changing its chemical makeup into an insoluble or stable form. If this can be done with hexavalent chromium, in this sites specific case, that chromium is then not available to be ingested or blown away or otherwise and released into the environment. With groundwater our different methodologies and technologies were assembled into four potential actions as well. We looked at no action, of course. There is a five-well pumping system in operation, as I mentioned, and our no actions do include this system operating, we're not simply going

to turn it off, but that would be all that would be done under this alternative. There are some problems with continuing to pump and treat alone, even though that was another alternative I mentioned, and you can have an extremely long time frame involved to accomplish that this way. You could also simply try to restrict people's usage of that water by restrictions and monitoring only of the groundwater in the affected area. Unfortunately, this is difficult to do in real life and impossible to enforce, but if you went that route, you might could prevent exposure, probably could if done properly. These involve some legal means, including deed restrictions, and you see the costs. Other options would include continuing to pump and treat; in fact, expanding pump and treat to simply pump more water and move more water off the moist area of the site of the affected plume. This is expensive, but more important, the same problems I mentioned earlier can occur. It's possible that the concentrations would drop but simply not very fast. When they do drop, they tail off, and the outer years of operation of such a system do not result in very much reduction in contaminate levels at all, making it inefficient over the long term. Finally, the same idea I mentioned for soil, you can do an insitu chemical treatment. Again,

this is an emerging technology, this is new, and the same process I mentioned, you use a reducing agent to actually change the form of that chromium within the groundwater. It may sound complicated but it's actually a rather simple instantaneous chemical change. What has to be worked out here is, is it permanent, does it stay gone, does it stay out of the groundwater? There is some technical work to achieve this; however, it does seem to have great potential. It's worth noting in this regard that the levels of chromium in soil are so much higher than the levels in groundwater. One way to think of it is that there is plenty of room in the soil matrix and simply adding chromium to that matrix, a typical concentration would be a thousand times higher in that soil than it would be in the groundwater. In the case of chromium, if the standard is multiplied by a thousand, the concentrations in soil are still much greater than that number. There's room, in other words, for this chromium to be bound up. Those were our options ... and let me mention before I get into this, that EPA ... the options for soil and ground water and EPA's preferred alternatives all include the continued operation of the pump and treat system, that is going to occur. They also include the ecological action that I mentioned, the small scale

sediment removal, and they mention ... I'm sorry, they include site monitoring which is always required at a Superfund site. The purpose of that is obviously to show that you know where and how bad the problem still is, and are you achieving the cleanup with your remedial action. The action EPA proposes to choose, which is referred to as the remedy or the preferred alternative, includes a ... I'm sorry, an alternative for soil and an alternative for groundwater. For soil and for groundwater, we're proposing to choose the insitu chemical treatment. I've listed here the components of what the remedy would be if we go this course. Continued operation, as I mentioned, of the pump and treat. All remedial actions of a Superfund have to have a design base and then a remedial action phase where you actually construct or do the remedy. In this case, our remedial design will be rather freewheeling, you could say, we've got to determine exactly how to do it. It is an emerging technology, there is limited information to draw on as to how to plan and accomplish this, and I'm going to ask Mr. Tim Holbrook here in a moment to try to shed some light on their ideas about how it can be done and how it was determined that this had problems at the site concerning the insuti chemical treatment. But in

remedial design, you have to figure these things out, the items I've listed. The remedial action, as planned in the Feasibility Study would include actually hauling away some of the most highly contaminated soil from the surface and treating the rest using the insitu chemical treatment methodology. To put this very simply, you use liquid solutions which are then either poured onto the ground or delivered into the subsurface by whatever means available to cause the chemical reaction. We then must monitor and see that the action occurs, show that it's happening and show that it stays that way. It's quite a tall order and, for that reason, the action is likely to include the things I've mentioned. It may require phase activities. There will have to be some consideration of how to evaluate that it is working and that we're placing the solution in contact with the groundwater, particularly on the groundwater side of the remedy. As I mentioned, site monitoring would be continued. We need to see that we're causing an effect on the surface water downstream in the tributary, and for that reason we've got to monitor in one place at least downstream somewhere. We have a continuation planned of the quarterly sampling that occurs now and that does include sampling the seep or spring that I mentioned, that sampling will continue.

Finally, the small scale sediment removal, which we will address and the remaining ecosystem concerns, et cetera. I'd like to ask Tim Holbrook, if he would, to explain a little bit more about insitu chromium production and what was done during the demonstrations, and that was one of the activities that occurred during

1994 and 1995 that led to the responsible party's interest and our interest in insitu chromium production.

MR. HOLBROOK: Thanks Ralph. First of all, just real briefly before we get into the Demonstration Study, this technology is considered innovative by EPA; in fact, there's been an EPA site demonstration done in Turlock, California. That's described very fully in the appendix to the Feasibility Study. And there's also been a demonstration project in New Hope, Pennsylvania, that's been approved by the State and is referred to there as well. SECOR, our company, is also involved in other sites in California as a voluntary cleanup using the same technology. The technology has been used very successfully. Wastewater treatment, in fact, is probably one of the chemicals used in the past to treat the chromium, so that the process chemistry is very well accepted. And in the soil and insuti environment, there are certainly questions that we need to address

those things specific, which is one of the reasons we completed this study. Our objectives were to demonstrate that the surface soils and the groundwater could be treated effectively with a very simple solution of ---. And there's two forms of chromium in the groundwater as well as in the soil, one of which is very soluble and one of which is not. The very insoluble form is trivalent chromium and it is very difficult to resoluablize, even though it's a solution. The hexavalent chromium which roman numeral number six indicates that it's a very soluble mobile and a very toxic form of chromium. The ferrous sulfate is very effective in changing the form of chromium from hexavalent to trivalent chromium. So we did a couple very interesting and very small scale experiments to see if this would indeed work in a small setting. In the overhead shot that Ralph showed earlier there was a indicated waste pond area, these pits were dug in the waste pond area that were about 18 inches deep and 4 feet by 10 feet. We weren't burying anybody, we were doing an experiment. We lined the excavation with plastic, we put the soils that were taken out of the hole, we segregated them on plastic, and then placed back in the hole in layers in which they came, so they were representative, as much as we could,

representative of the natural soils that are in the waste pone area which was the highest chromium concentration. The drain pipe you see there was used to collect leachate after the various treatments of the ferrous sulfate that were applied. The results of the soil testing indicated that by applying a very small concentration of ferrous sulfate, as little as eight grams applied, we had a very significant decrease in the concentration of the hexavalent chromium. The original zero treatment, far on the left, results in 600 micrograms per kilogram concentration of hexavalent chromium, with the eight milligrams added, it's about half of that. And when we get to the 400 level, we had a very difficult time finding any hexavalent chromium. We were encouraged by this and feel that treatment concentration is probably somewhere between eight and 400 milligrams level. This is strictly by treating the soil with a very dilute solution and spray it over the top of the soil, that's simply what we did. To investigate this concept in the groundwater itself, we used a couple of existing wells and a couple of injection wells to inject, again, a very low concentration of ferrous sulfate, and what we found was, that when we injected ferrous sulfate solution and monitored the quality of groundwater in the vicinity and downgrading of that well, we saw a very substantial decrease in the concentration of hexavalent chromium. The green line indicates the treatment, which we added the ferrous sulfate, and prior to adding the ferrous sulfate we had a test in which we just had tap water and chloride. That's the yellow line. So without the treatment, we saw a decrease in concentration from about 1500 micrograms to maybe 1,000 micrograms in the groundwater. However, when we used the ferrous sulfate treatment, we took that all the way from the 1500 or so level down to non-detectable, less than about 10 micrograms per kilogram of hexavalent chromium. So this indicated a very positive potential for the use of this technology in the soils. A couple of other things that we did to supplement this were, was to investigate the long term stability of the treated soils. We collected some soils that had been treated in the plots that you saw earlier and subjected them to vigorous PH testing under varied PH conditions which would simulate successful rainfalls and the normal environment; in fact, we even went as far as contacting the local weather service and the USGS and constructing a simulated rain itself that was comparable to rainfall that you get in the area in terms of its chemicals existing in the PH acid base. We used that to leach the soils that we obtained from the plots over several weeks and found that we still were unable to leach out the hexavalent chromium because it had changed to trivalent chromium, which is insoluble. So that's one of the things we did. The other thing we did was come up with a leachability factor to be used in the development of the remediation, and all that information is provided in the appendices to the Feasibility Study.

MR. HOWARD: Thank you. If you are-interested in the specifics of what was done on both the Demonstration Study and later the Feasibility Study concerning feasibility and the stability of the reaction that Tim and SECOR investigated, there is great detail on that in the Feasibility study which contains the Demonstration Study report as one of its appendices. So you may wish to look further there. So from here we go to ... we go eventually to cleanup, but we would like to hear from you first. We have a legally established public comment period which will extend for another couple of weeks, three weeks now, through October the 7th, at that time we will close the public comment period and we will ... I will sit down and address these concerns, letters, comments that I receive concerning what EPA is doing. You see the

public meeting listed there tonight. In the record of decision, which will be issued in November of this year, EPA will address in writing all the concerns brought to us and address those. EPA has on occasion modified records of decision, modified the preferred alternatives, none of those things are ... there's no reason why those could not happen here as well if you do not like what you're seeing. But we do plan to issue the record of decision in November, again depending on public comment. From there we arrange a legal agreement with the responsible parties. Textron has done all the work requested of them to date and we expect to, in fairly short order, reach a legal agreement for continuing this action at the Townsend site. Following that, the remedial design that I described earlier would begin, obviously it begins with planning. That would certainly be true in this case where we are really starting from scratch as to the ... we're not starting from scratch, but we are starting with new innovative technology. We do have to plan out very carefully that work. It's hard to predict exactly when the first solutions might hit the ground or work towards the groundwater, but certainly by next summer we'd like to see activities underway in the remedial action. So this is where we go from here and we'd

certainly like to hear any concerns or questions you might have. I would ask that you identify yourself for our court reporter so that she'll know who's asking the question, and I will repeat questions if they are necessary, as necessary. Are there any questions? If there are any questions at all, now is your chance.

(No questions are posed)

All right, thank you for coming. Please stay afterwards and talk with us if you will, we certainly want to keep you informed. I appreciate your attending tonight and, again, thanks for coming.

(There being nothing further, the hearing was adjourned at 8:01 p.m.)

CERTIFICATE

This is to certify that the within Public Hearing, consisting of Twenty-eight (29) pages, is a true and correct transcript of the hearing; said hearing was reported by the method of Stenomask with Backup.

I further certify that I am neither employed by nor related to any of the parties in this matter or their counsel; nor do I have any interest, financial or otherwise, in the outcome of same.

IN WITNESS WHEREOF I have hereunto set my hand and seal this 30th day of September, 1996.

<IMG SRC 97019R>

Notary Public for South Carolina
My commission Expires: 3/6/1999

CREEL COURT REPORTING, INC.
1720 Main Street, Suite 202 / Columbia, SC 29201
(803) 252-3445 / (800) 822-0896

APPENDIX B

STATE OF SOUTH CAROLINA CONCURRENCE LETTER

<IMG SRC 97019S>